SONY

Training Manual

BA-6 Chassis

Models: KV-13FS100
KV-13FS110
KV-20FS100
KV-20FV300
KV-24FS100
KV-24FV300



KV-24FV300

Circuit Description and Troubleshooting

Course: CTV-30

Table of Contents

Introduction

Overview

This course will cover the new BA-6 chassis. The USA model sizes for the BA-6 chassis are 13", 20" and 24". This chassis has major circuit changes from the BA-5 chassis, the main one being the integration of Syscon, YC Jungle and Comb Filter into one IC package (called One-Chip). Other changes are in the Power Supply (Main and Standby) and the Audio section. The Vertical and Horizontal deflection section are similar to previous chassis's except for the Horizontal Output transistor, which is a new design. Although this single chip design may seem to eliminate a large portion of circuit troubleshooting, there are still discreet circuits and external ICs that can fail. In addition, when the unit becomes defective, a good understanding of the One-Chip IC functions will be needed to determine if the problem is in the One-Chip IC or in external circuits.

CTV-30 Objectives

- Cover features of the BA-6 chassis.
- Define the One-Chip design.
- Provide a Theory of Operations (Waveforms and Voltages) and Troubleshooting Tips for each major section of the BA-6 chassis.
- Discuss unit Self-Diagnostic functions and how they can assist in troubleshooting.

Chapter 1 - Features

Overview

This section covers the Audio, Video, Convenience features of the BA-6 chassis models. Also included is a Features Glossary.

BA-6 Chassis Models:

KV-13FS100	**KV-13FS110**
KV-20FS100	**KV-20FV300**
KV-24FS100	**KV-24FV300**

NOTE: The BA-6 chassis meets the **Energy Star**® guidelines for energy efficiency

Audio Features

Reference Table 1-1 for the Audio features of each model using the BA-6 chassis.

Table 1-1 – Audio Features per Model

	Audio Power	Speaker Box	Head-Phones (wired)	Audio Output Var/Fix	MTS	Steady Sound	Audio Effects	Auto Mute
13FS100	3Wx2	NO	YES	NO	YES	NO	NO	YES
13FS110	3Wx2	NO	YES	NO	YES	NO	NO	YES
20FS100	5Wx2	NO	YES	NO	YES	NO	NO	YES
20FV300	10Wx2	YES	YES	YES	YES	YES	YES	YES
24FS100	7.5Wx2	NO	YES	NO	YES	NO	NO	YES
24FV300	10Wx2	YES	YES	YES	YES	YES	YES	YES

NOTE: Reference feature glossary for definition of terms.

Audio Effects includes the following:

- **Simulated Stereo**
- **WOW**
- **SRS**

Video Features

Reference Table 1-2 for the Video features of each model using the BA-6 chassis.

- **FD Trinitron WEGA TV (Flat CRT)**

Table 1-2 – Video Features per Model

	3D Comb filter	S-Video Input Rear	Tilt Correction	V.M	Video 2 Input Front	YUV Input Rear	V-Chip	XDS/CC
13FS100	YES	NO	YES	NO	YES	YES	YES	YES
13FS110	YES	NO	YES	NO	YES	YES	YES	YES
20FS100	YES	NO	YES	YES	YES	YES	YES	YES
20FV300	YES	YES	YES	YES	YES	YES	YES	YES
24FS100	YES	YES	YES	YES	YES	YES	YES	YES
24FV300	YES	YES	YES	YES	YES	YES	YES	YES

NOTE: Reference feature glossary for definition of terms

Convenience Features

All BA-6 chassis models contain the following Convenience Features:

- **Auto Channel Programming**
- **Channel Label**
- **Favorite Channel**
- **Front Panel Controls (Including On-Screen Menu)**
- **Parental Control (V-Chip)**
- **Real Time Clock**
- **Trilingual Menus (English, Spanish, or French)**
- **Two Event Timer**
- **Video Label**

Feature Glossary

Audio

Audio Effects – Covers three sound effect modes: Simulated Stereo, WOW and SRS.

Auto Mute – A feature designed to automatically mute the TV audio when no RF signal is received

BBE – Shifts the phase of the audio signal to improve TV sound.

MTS – Allows direct access to the Multi-Channel TV Sound: Stereo, Mono or Auto SAP (Second Audio Program) with a touch of a button.

Simulated Stereo – Simulates stereo quality sound for mono programs.

Speaker Box – A speaker enclosure used to improve sound quality.

SRS – Produces a dynamic three-dimensional sound for stereo audio signals (surround sound virtual speakers).

Steady Sound – Stabilizes volume during sudden sound fluctuations of received audio.

WOW – Provides a dramatic presence with full, deep bass sound. When WOW is enabled, BBE is directly activated to further enhance the audio program.

Video

3D comb Filter – Looks at the horizontal line above and below the line being processed, along with the same three lines in the frame before and after, to optimally remove the chroma component from the Y in a composite video signal. This reduces dot crawl and other noise to produce the best picture possible.

V-Chip – (Parental Control) Allows parental control over rated television programs.

VM – (Velocity Modulation) Sharpens the picture definition by varying the beam-scanning rate to give every object a sharp, clean edge.

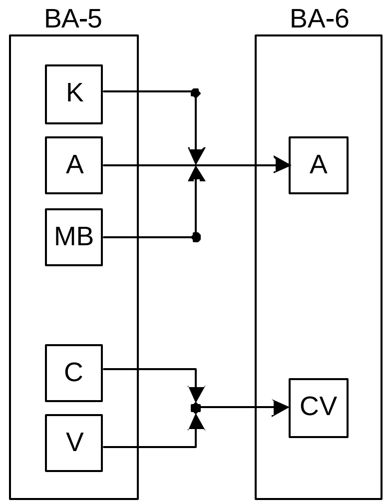
XDS/CC – Information services that some broadcasters are adding to their signals, including time, station call letters and programming information.

YUV – (Component Video) Delivers optimum picture quality by supplying separate connections for the luminance (Y) and color information (UV).

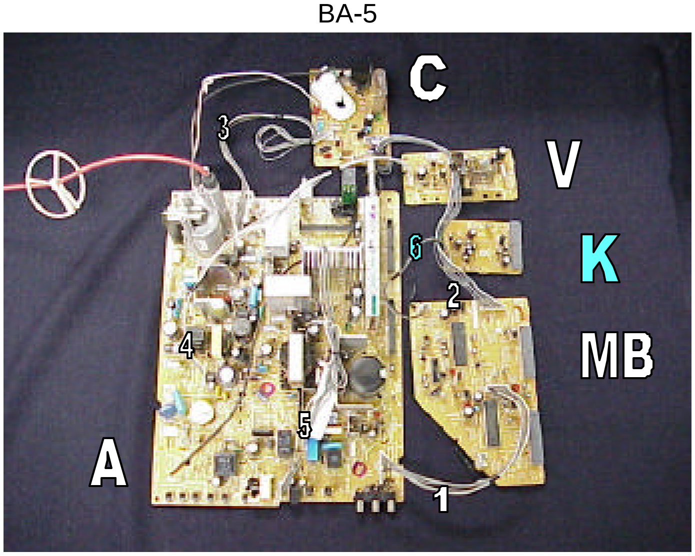
Chapter 2 - Overall BA-6 Block

Overview

The BA-6 chassis has taken a major step towards the “TV on a Chip” concept. The <u>One Chip</u> (IC001) performs all System Control and Signal Processing functions. In previous models these functions were handled by three different ICs: System Control, YC Jungle and Comb Filter. A direct result of the higher circuit integration is the lower PCB count. The number PCBs went from five in the BA-5 to only two in the BA-6 chassis (as illustrated in Figure 2-1).



BA-5



BA-6

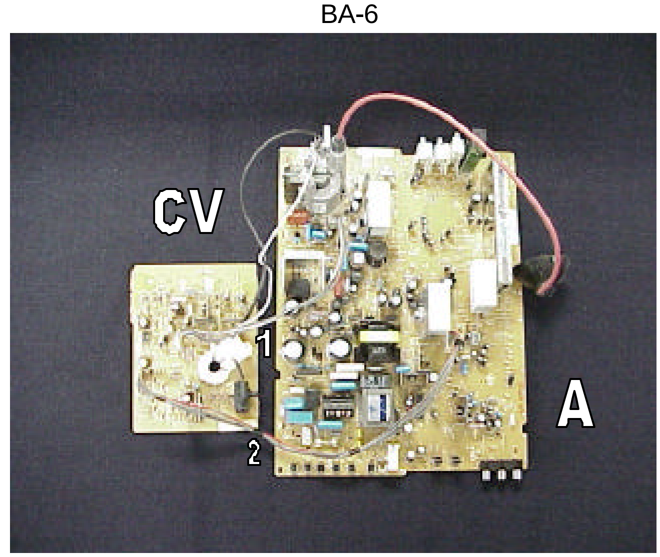


FIGURE 2-1 - BA5 - BA6 BOARD COMPARISON 2.1CTV30 3/11/02

A Board

The A board contains all the Power Supply, System Control, Deflection, Video Processing and Audio Processing circuits.

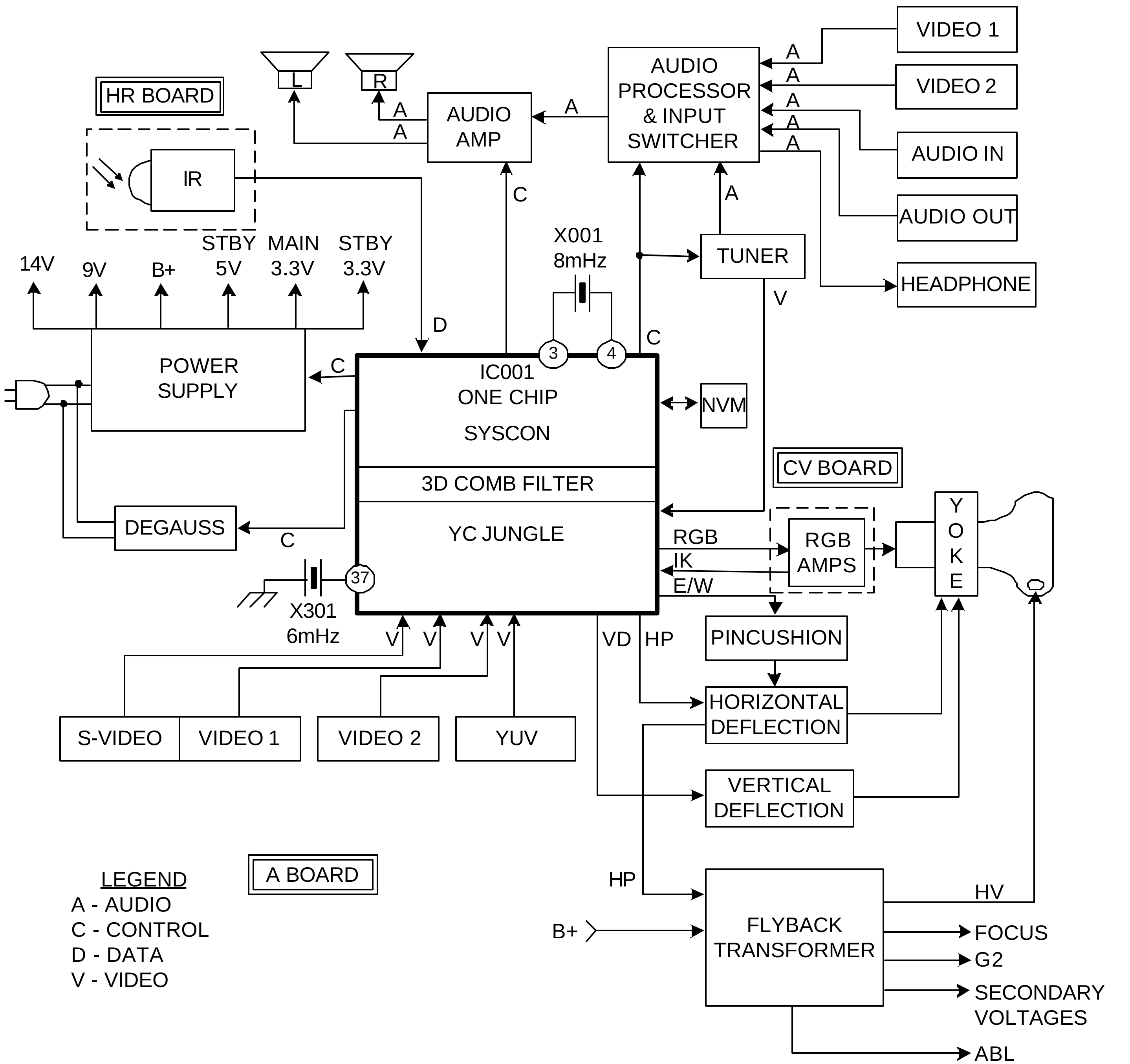


FIGURE 2-2 - OVERALL BLOCK

2.1CTV30 3/25/02

System Control

All system control functions are performed by IC001 (OneChip). The main operating crystal is X001 (8MHz). The following control functions are handled by IC001:

1) Remote commands (SIRSC) decoding
2) Main Converter Power Supply ON/OFF
3) Audio IC Input switching (commands ONLY)
4) Audio Muting and Volume Control
5) Video Input Switching (Performed Inside IC001)
6) Degauss ON/OFF
7) Tuner Control and Muting

Power Supply

The Standby Power Supply on the BA-6 is Energy Star® compliant. It supplies Standby 5V and Standby 3.3V to keep various circuits on the A board active in Standby Mode. The Main Converter Power Supply supplies the rest of the voltages (+135V, 14V, 9V, Main 3.3V) to the A board when an ON command is received..

Audio Section

The A board contains audio switching, processing (both of these functions are performed in IC400 for the appropriate models) and amplifier circuits. The only circuit change on the A board between models is the Audio processing IC. The KV-20FV100, and KV-24FV300 use IC400 (IC400 contains the Surround Sound processing circuits); the KV-20FS100, KV-24FS100, and KV-13FS100/110 use IC401. All models use Audio Amplifier IC404.

Video Section

All Front/Rear Video input jacks and the Tuner are located on the A board. All video switching and processing is performed by the ONE-Chip (IC001) on the A board. New on the BA-6 chassis is the addition of a component (YUV) jack on the rear of the unit. Crystal X301 (6MHz) is used for NTSC signal (Composite) color signal processing. If X301 is defective, the unit will still operate normally, except the picture will be in Black and White.

Deflection

The Horizontal, Vertical and Pincushion correction circuits are all on the A board. These circuits, along with the Fly-back transformer, drive the CRT electron beam for picture scanning. The Horizontal output transistor is new on the BA-6 chassis for better performance.

The Degauss circuit and relay is also on the A board.

CV Board

The CV board connects to the neck of the CRT via J1751. The circuits found on this PCB are the RGB amplifier and buffer transistors and Output Drive IC (IC1751), N/S Amplifier and VM Drive circuit. The N/S amplifier and coil are used to rotate the trace for good level horizontal scanning (Tilt Correction). The VM (Velocity Modulation) circuit assists in sharpening the image when transitioning from Black to White and visa-versa.

Chapter 3 - Power Supply

Power Supply Block

The power supply section in the BA-6 chassis is labeled Energy Star® compliant. This means that the power supply meets or exceeds the power conservation standard set forth by the EPA and the Department of Energy. That standard states that an analog TV should draw ≤1 Watt in Standby Mode. For more information on Energy Star, go to www.energystar.gov. The power supply section consists of the 5V Standby Supply and the Main Converter Switching Supply (ref. Figure 3-1). Also included in this diagram is the Degauss circuit.

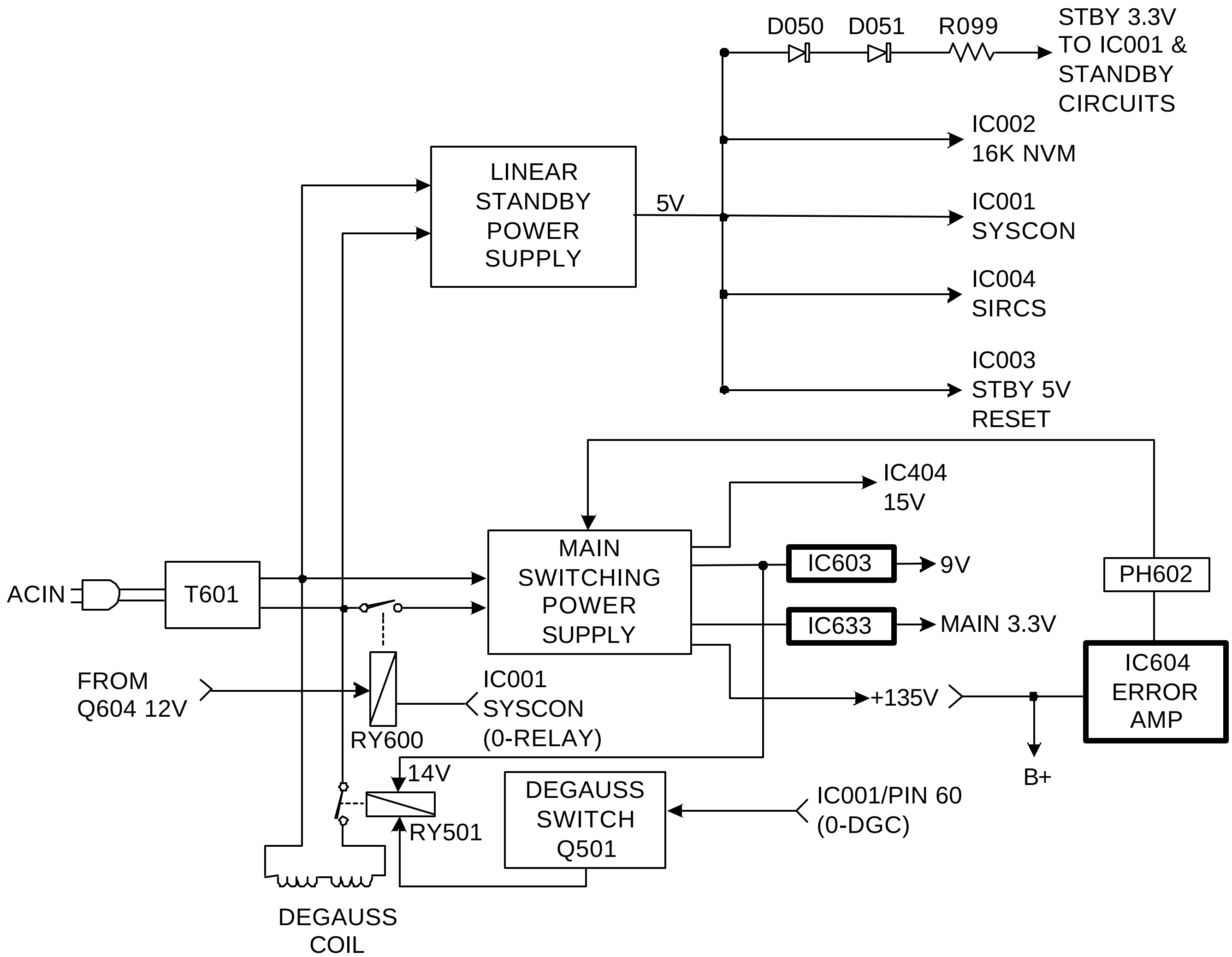


FIGURE 3-1 - POWER SUPPLY OVERALL BLOCK 3.1CTV30 3/26/02

5V Standby Power Supply

The Standby Power supply in the BA-6 chassis is a Conventional Full-wave rectifier, capacitor filtered type. This is a departure from previous models, which use switch-mode power supplies in the standby circuit. The AC input to the Standby supply is connected directly across the ACIN source, before the AC input relay RY600. So, the Standby Power supply outputs the voltages listed on Figure 3-1 once AC is applied to the set.

Main Switching Power Supply

As in previous models, the Main Switching supply is a switch-mode power supply. The Main supply receives AC input through relay RY600 after System Control receives an ON command. Once the switching oscillations begin and feedback (through IC604) is established, the Main Power outputs the voltages listed in Figure 3-1.

Degauss Circuit

The degauss circuit consists of the Degauss Coil, Degauss Switch circuit (Q501) and relay RY501. b The DC power (14V) for the relay comes from the rectifier circuit (D621, C616, L607 and C632) that feeds the 9V regulator circuit. The Degauss circuit is activated once System Control (IC001) receives a Power-ON command. IC001/ pin 60 (O-DGC) outputs a High to turn Q501 ON and ground is applied to RY501. RY501 activates briefly (approximately one second and then shuts off) and the hum of the degauss coil can be heard. The degauss coil eliminates any magnetic fields present in metallic parts in the picture tube, which could cause color purity problems.

5V Standby Power Supply & Power-ON Switching Circuits

5V Standby Power Supply Circuit

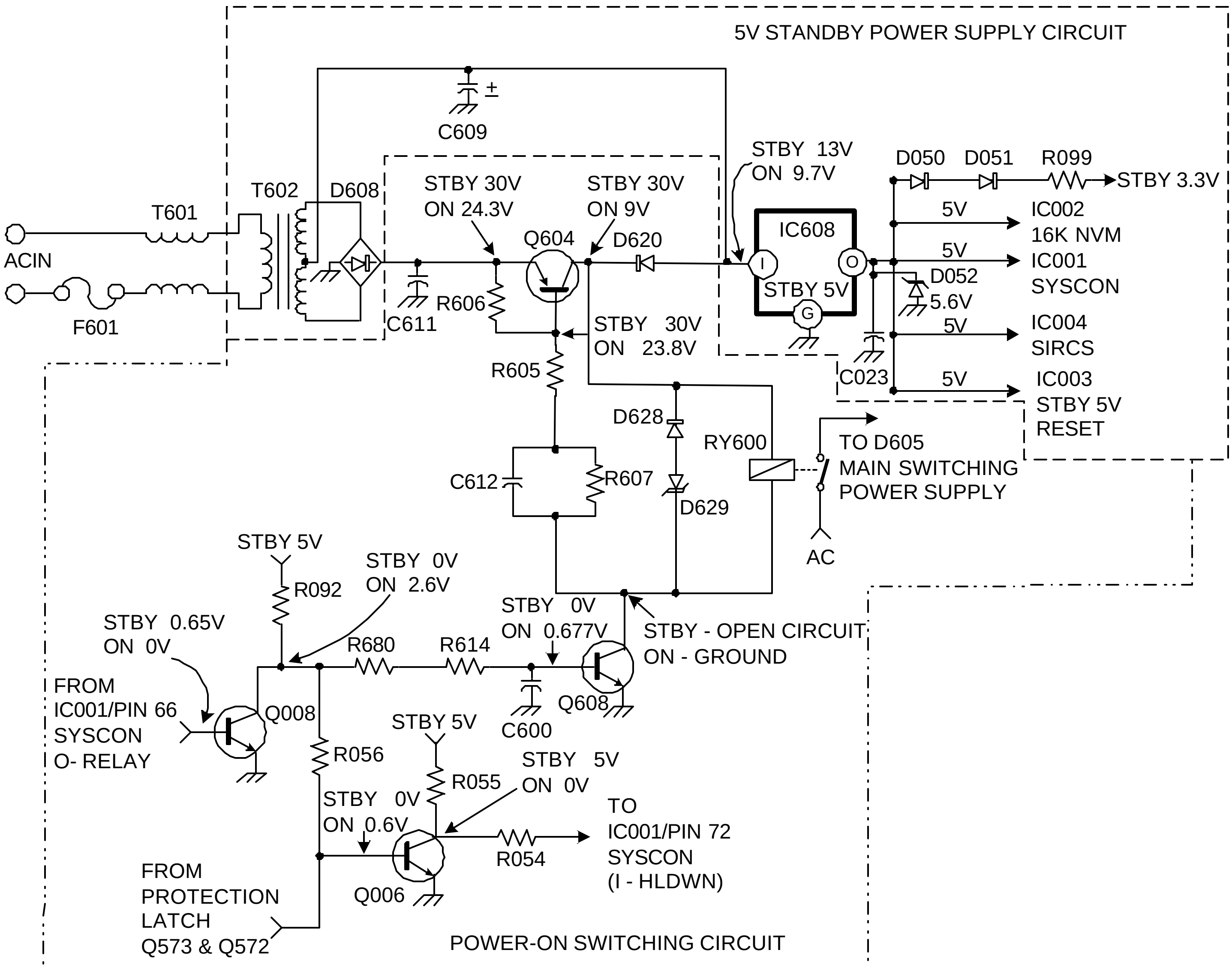


FIGURE 3-2 - 5V STANDBY POWER SUPPLY & POWER-ON SWITCHING CIRCUIT

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Reference Figure 3-2 for the following circuit description:

The Standby Power supply is operational as long as the set is plugged into an AC outlet. AC power is applied through choke T601 and transformer T602 to the full-wave rectifier block D608. Capacitor C609 filters out the AC component and a DC voltage of 13V is applied to IC608 (Input Pin). IC608 then outputs the Standby 5V to activate the circuits listed on the diagram at the output of IC608. A Standby 3.3V source is produced from the Standby 5V source using components D050, D051 and R099.

The voltages labeled “STBY” on the diagram are the voltages present at the designated points in Standby Mode.

Power-ON Switching Circuit

Reference Figure 3-2 for the following circuit description:

In the Standby Mode, the System Control (IC001) is partially ON (using the Standby 5V and Standby 3.3V), and waiting for an "ON" command from either the Front Panel Controls or the Remote Control Input (IC004 not shown).

Once the System Control IC001 receives an "ON" command at either IC001/pin 70 (I-SIRCS) or IC001/pin71 (I-PWR), it outputs a LOW (0V) at IC001/pin66 (O-RELAY). <u>IC001 is not shown on this diagram</u>.

The LOW from IC001/pin 66 is applied to the base circuit of Q008. Q008 turns "OFF" and 2.6V appears on the collector through pull-up resistor R092. After passing through dropping resistors, the 2.6V source supplies approximately 0.6V to the base circuits of Q608 and Q006.

Q608 turns "ON" and supplies a ground to the AC relay RY600 and to the bottom of C612 and R607. The ground at the bottom of C612 and R607 turns "ON" Q604, which supplies initial high current to the AC relay RY600 through its emitter/collector junction. Q604 shuts OFF once C612 is fully charged, and now RY600 receives its ON/HOLD voltage of 9V through D620. D620 acts as a blocking diode when Q604 initially supplies current to RY600. RY600 actuates and sends AC voltage to rectifier block D605 in the Main Switching Power Supply (operation will be discussed next).

Q006 is turned "ON" in normal operation, supplying a LOW (0V) to System Control IC001/pin 72 (I-HLDWN). Q006 is used to tell the System Control IC001 to activate the self-diagnostics indicator (HLDWN operation is discussed in the Protection circuit section).

Troubleshooting Tip:

Obviously, if a failure occurs in the 5V Standby Power Supply the unit will not even attempt to turn ON. If this condition occurs, check the following components:

1) F601
2) 13V at IC608 Input Pin (I). If missing, suspect T602, D608, and/or C609
3) 5V at IC608 Output Pin (O). If missing, suspect a defective IC608.
4) NOTE: Q604 is used as a current source for the AC relay (RY600). If Q604 the collector/emitter junction becomes an Open circuit, the set will still turn ON (using voltage through D620) and function properly with sufficient AC power input. If the AC power input is weak (Low Voltage ~90VAC, the unit will have difficulty turning ON without Q604 functioning properly.

Main Switching Power Supply Circuit

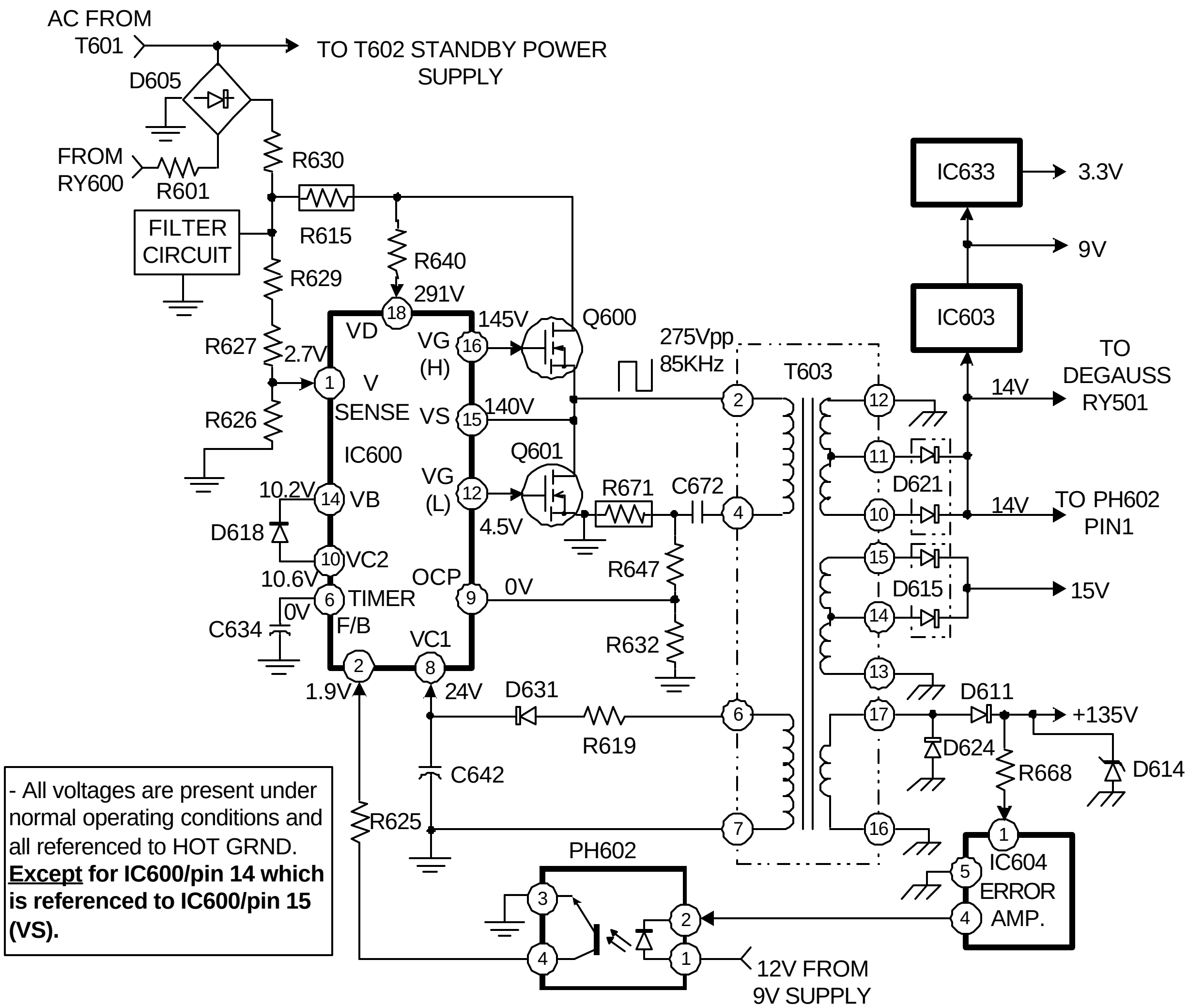


FIGURE 3-3 - MAIN SWITCHING POWER SUPPLY 3.3CTV30a 1443 3/26/02

The Main Switching Power supply is basically IC600 (Switch Regulator Controller). IC600 contains all the needed circuitry necessary to function as a switching power supply, except for the Power Switching MOSFETS (Q600 and Q601).

IC600 contents:

- Control circuit
- Oscillator/Oscillator control
- Output Driver transistors
- 10V regulator
- Shut-Off Timer
- Over Current Protection

Main Switching Power Supply Operation

Reference Figure 3-3 for the following circuit description:

AC signal is applied to the rectifier block D605. The AC component is filtered-out by the filter circuit (C629 and C621 shown in block form). A DC voltage of 293V is produced at this time.

IC600 Startup Sequence

1) **Turn ON voltage:** The 293Vdc from the filter circuit is voltage divided by R630, R629, R627 and R626 down to 2.7Vdc. This voltage is applied to IC600/pin 1 (Vsense) and IC600 turns ON. IC600/pin 1 (Vsense) is also used for OVP protection (IC001/pin 1 > 8 volts will trigger OVP).

2) **Internal circuit Start Voltage:** The 293Vdc also passes through voltage dropping resistors R615 and R640, and 291Vdc is applied to IC600/pin 18. This voltage is used to initially power the internal circuits and begin oscillations. Note that the 293Vdc from R615 is connected directly to the Drain of Q600 and serves as the High-side FET power source.

   Internal circuits initially power by IC600/pin 18

   - Internal drive transistors for High-side output FET Q600.
   - Oscillator
   - Control circuit
   - 10V regulator (IC600/pin 10)

     Note: The 10V output at IC600/pin 10 passes through D618 and supplies power to the internal driver transistor for the Low-side output FET Q601

3) **Output Oscillations:** At this point, initial square-wave oscillations of approximately 125KHz are output at IC600/ pins 16 and 12. Normal operation frequency is approximately 85KHz.

4) **Regulator Feedback**: The feedback line is connected to the +135V secondary output. Once IC600 is turned ON and oscillations begin, the secondary winding at T603/pin 17 and associated circuitry produces +135. The +135V is applied to Error Amp. IC604/pin 1.

   IC604 outputs an error voltage, which controls the current output of the optic-coupler PH602. The amount of current supplied to IC600/pin 2 depends on how hard PH602 is turned ON. In normal operation, a voltage of 1.9Vdc (which is proportional to the amount of current) is present at IC600/pin 2. The feedback loop is now complete.

5) **IC600 normal operating power supply (VC1)**: Produced simultaneously with the oscillator feedback is the operating power source VC1.

   IC600/pin 8 (VC1) is produced using a primary winding on T603/pin 6. The AC is rectified, filtered and a DC voltage of 24V is applied to IC600/pin 8. Once the 24V is stable, IC600's internal control circuit disconnects (internally) the power source at IC600/pin 18. All IC600 internal circuits are now powered from IC600/pin 8.

Over Current Protection (OCP): ref. Figure 3-3

The current flowing through the switching FETS (Q600 & Q601) also passes through R671. The voltage drop across R671 is directly proportional to the current through the switching FETS. The voltage across R671 is voltage divided by R647 and R632, and applied to IC600/pin 9. The OCP is activated when the voltage at IC600/pin 9 exceeds 0.2V. The self-diagnostic indicator will flash four times, pause and then repeat.

Over Voltage Protection (OVP) and Under Voltage Protection (UVP): The voltage at IC600/pin 8 (VC1) is monitored by circuitry inside IC600 for Under-voltage and Over-voltage conditions. The two conditions are as follows:

OVP – greater then 33V

UVP – less then 8V

If either of these two conditions occur at IC600/pin 8, the unit will go into protection mode. The self-diagnostic indicator will flash four time times, pause and then repeat.

Troubleshooting Tips (ref. Figure 3-3)

NOTE: Follow previously discussed “IC600 Startup Sequence”. The five steps are in order of occurrence.

NOTE: Use HOT GRND when making measurements on primary side of T603. This includes all measurements on IC600.

Symptom: Unit goes into protection mode LED flashes four times.

Check: This indicates either a Vertical deflection or Power Supply problem.

1) Check power supply secondary outputs.

- If voltages are present and at the proper level, then the problem is in the Vertical deflection drive circuit.
- If the secondary voltages are low or missing, then the problem is in the power supply.

2) The power supply can be safely tested by unloading the +135v line. Unsolder R591. This will unload the +135V line of the power supply, but still send needed feedback to IC600 for proper power supply operation.

3) If the power supply outputs proper secondary voltages after unsoldering R591, suspect a shorted +135V line. Check the Horizontal Output transistor (Q505 or 506) for shorted conditions.

4) If the unit still goes into protection mode after unsoldering R591, check the following items:

- D614 for shorted condition.
- IC600/pin 15 (this is midpoint for output MOSFETS Q600 and Q601). A 275Vpp, 85KHz square-wave should be present. If the waveform pulses four times and stops, check the next Item.
- IC600 Feedback circuit. The amount of current feedback can be determined by monitoring the voltage drop across R625. The minimum current feedback is 80uA, which is a minimum voltage drop of 37.6mV. In normal operation, this voltage drop is approximately 223mV. If the voltage drop is below 37.6mV, suspect components in the feedback path e.g. PH602 and IC604. Reference Figure 3-3 for proper voltages at these components.
- If no waveform is present when unit is turned ON, then check IC600/pins 1 and 18 for proper voltages (reference “IC600 Startup Sequence” above).

  If these voltages check OK, check IC600/pin 8 for proper voltage of 24V. This is the voltage used to power IC600 after initial startup.

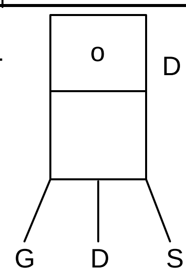
  If 24V is present at IC600/pin8, check IC600/pin 10 for 10.2V. This voltage is developed using the 24Vs and a voltage regulator circuit inside IC600. If 10.2V is missing, suspect a defective IC600. Also check voltage at IC600/pin 14 **(Use battery powered VM for this measurement, and use IC600/pin 15 (VS) as ground ref.)**. The voltage at IC600/pin 14 should be 10V. If the voltage measured at IC600/pin 14 is incorrect, check D618.
- If all the above measurements check OK, suspect a defective IC600.

5) Defective Output MOSFET transistors: The output MOSFETS will cause a “no output square-wave” condition. To properly test MOSFETS, reference the following test procedure:

Static MOSFET Resistance Tests – Table 3-1

Table 3-1 - Static MOSFET Resistance Tests		
	+ / -	- / +
Gate – Source	Infinity	Infinity
Gate - Drain	Infinity	Infinity
Drain - Source	There is a zener diode connected internally across these terminals	

Power MOSFET
TO 220 case
P or N channel



Operational Test

To prove the device is functional:

1. Connect the negative lead of the ohmmeter to the SOURCE lead.
2. Touch the ohmmeter positive lead to the gate, to pre-charge it.
3. Connect the ohmmeter positive lead to the DRAIN.

If the device is good you will get a resistance reading of about 400-1k ohms.

Chapter 4 - Deflection Circuits

The One Chip IC001 contains the YC Jungle. Vertical Drive, Horizontal Drive and Pincushion Correction circuits are all located on the A-board in the BA-6 chassis. In the BA-5, these circuits are divided up between two boards: the A-board and MB board. Aside from the higher circuit integration, the circuit operations remain unchanged from previous models. So, a brief circuit theory of operation will first be discussed. The next two sections and diagrams following that will concentrate on deflection troubleshooting tips.

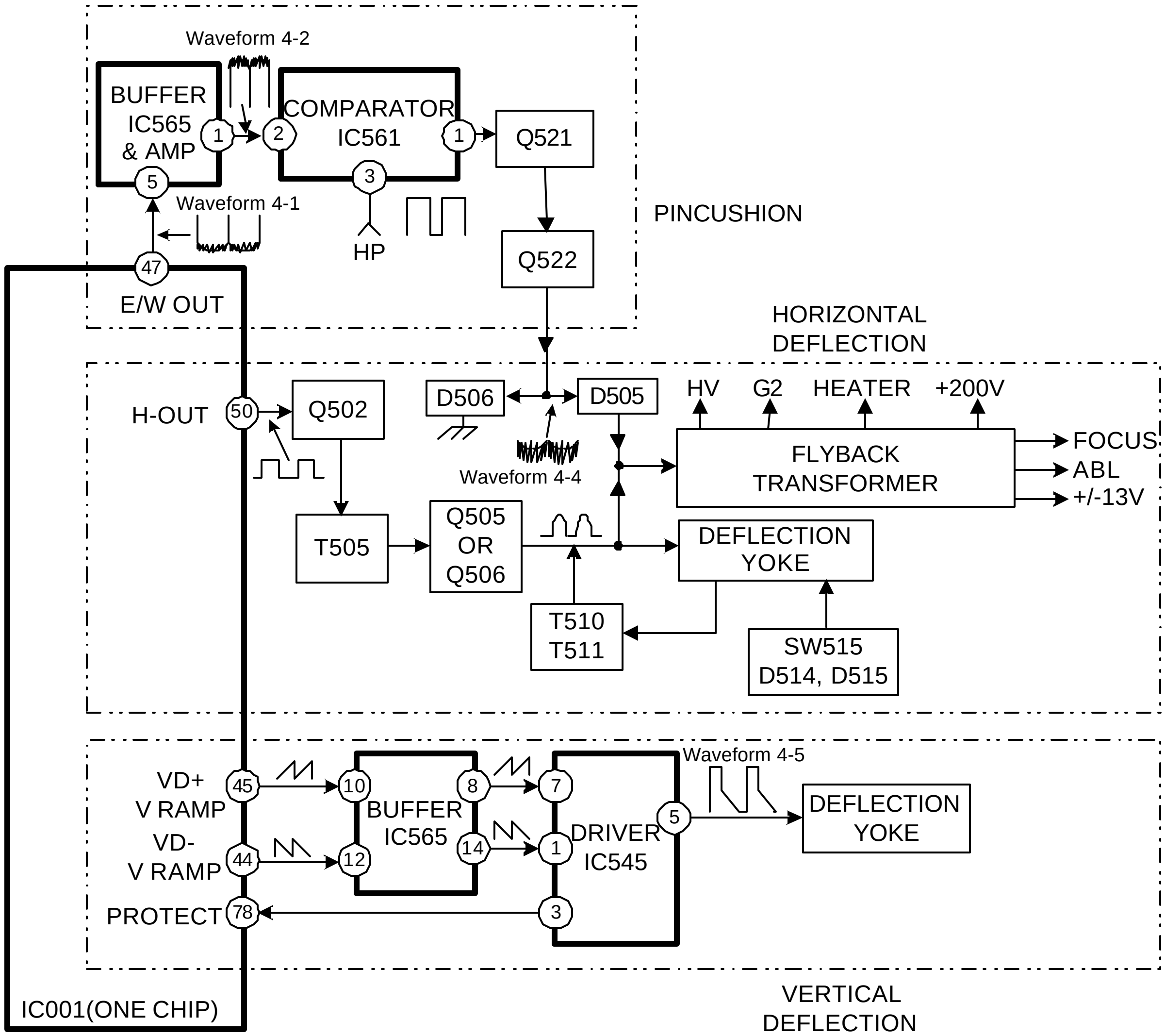


FIGURE 4-1 - DEFLECTION AND PINCUSHION OVERALL BLOCK

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Vertical Theory

Note: Reference Figure 4-1 during circuit description.

The VD+ and VD- Vramp signals are generated by the YC Jungle circuitry internal to IC001 (OneChip). The 180 degrees out-of-phase ramp waveforms are output from IC001/pin 45 (VD+) and IC001/pin 44 (VD-). The ramp waveforms first pass through buffer IC565 (Input pins 10 and 12; Output pins 8 and 14), and are then applied to the Vertical Drive IC545.

The Vertical Drive IC receives the ramp waveforms on IC545/pins 7 and 1, and outputs the final drive signal on IC545/pin 5. This final signal drives the deflection yoke for vertical scan on the picture tube.

If the vertical deflection circuit is defective, IC545/pin 3 outputs a protect signal to IC001/pin 78. This function will be discussed in the upcoming Protection circuit section.

Horizontal and Pincushion

Note: Reference Figure 4-1 during circuit descriptions.

Horizontal Theory

The Horizontal Drive pulse (HD) is developed inside IC001 (OneChip) and output on IC001/pin 50. The HD is first amplified by drive transistor Q502 and then applied to T505. T505 couples the signal to the Horizontal output transistor Q505 or Q506 depending on model; Q506 is used in 20"; Q505 is used in 24". At this point, the Horizontal output signal goes off in two directions. The signal is applied to the Fly-Back Transformer (FBT) and is used to develop HV, G2, Heater, +200, Focus, ABL and +/- 13 voltages. It is also applied to the Horizontal deflection yoke for horizontal scanning on the picture tube.

Pincushion Theory

Also shown on this diagram is the Pincushion correction circuit. The purpose of this circuit is to compensate for the non-linear scanning characteristics of the horizontal deflection circuit. The distortion caused by this non-linearity is the sides of the picture are bowed inward. The pincushion signal is used to incrementally increase the drive current to the horizontal deflection yoke as the beam is scanned down the picture tube. The drive current increases as the beam passes through the middle edge section of the tube.

Vertical Deflection Circuit

Note: Reference Figure 4-2 during troubleshooting descriptions.

Overview

Troubleshooting of the vertical deflection circuit will be the subject of this section. When the vertical section is operating correctly, pulses are output from IC545/pin 3 and applied to System control section of IC001/pin78. This signal tells System Control that the vertical drive IC545 is working properly. If the vertical section becomes defective, the pulse from IC545/pin 3 will stop and obviously so will the pulses at IC001/pin 78. System Control will now turn Off the AC Relay (RY600), and the Standby/Timer LED will flash four times, pause and repeat until the defect is fixed.

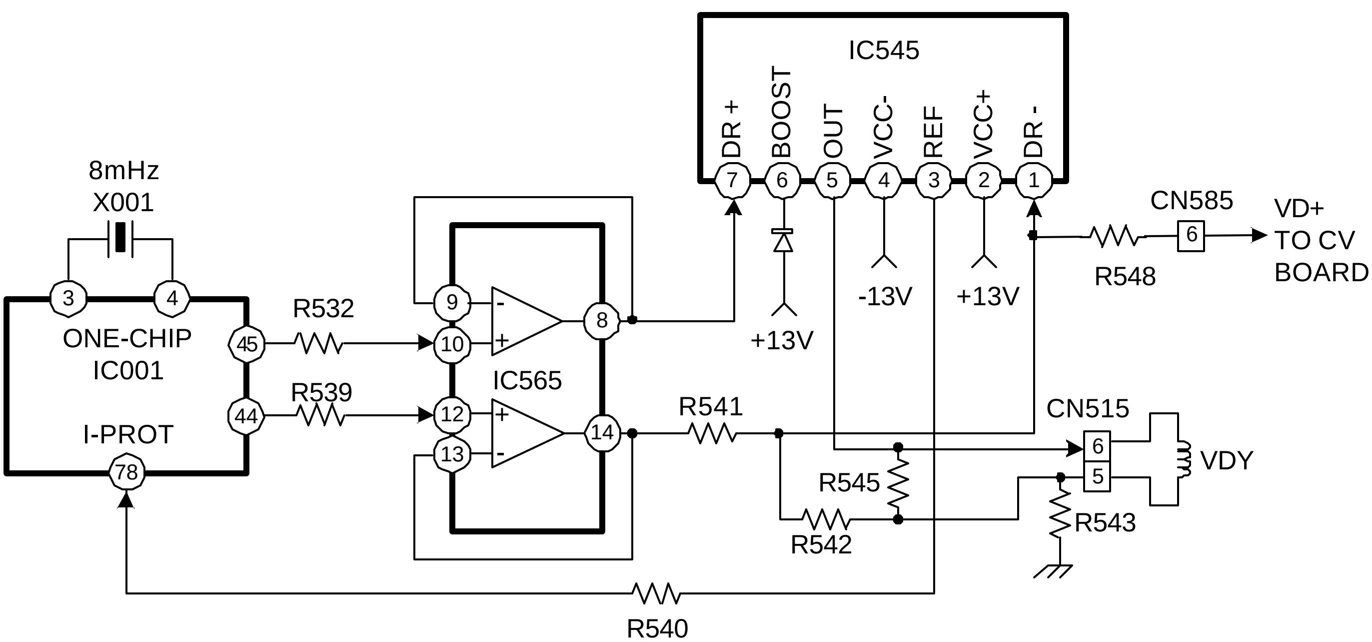


FIGURE 4-2 - VERTICAL DEFLECTION CIRCUIT 4.2CTV30 3/27/02

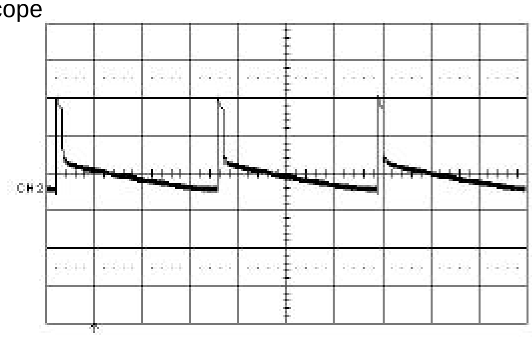
Troubleshooting

There are three defects can cause the Standby/Timer LED to flash in groups of four:

1) +13V and/or –13V from FBT/pins 9 and 7 respectively are missing on Vertical Drive IC545.
2) Vertical Drive IC545 is defective (no reference pulses output on IC545/pin 3 to IC001/pin 78).
3) No Horizontal Drive pulse to FBT. **NOTE:** Not a short circuit on the horizontal output, this would cause a B+ OCP condition (two-time flash).

The following troubleshooting tips are assuming a **"No Output Signal"** condition exists on IC545/pin 5. The output signal on IC545/pin 5 should appear as shown in Waveform 4-5.

Oscilloscope
Settings:
20V
5ms

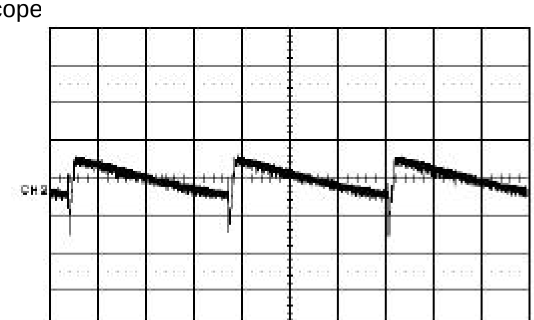


IC545/Pin 5 (Vertical Deflection Coil Drive Signal
Waveform 4-5

First, **confirm that the +/- 13V supplies** to IC545/pins 2 and 4 are coming from the FBT. If the voltages seem low, unsolder IC545/pins 2 and 4 and check the supplies again for proper level. If there is a problem with the +/-13V supplies, check the Horizontal Drive pulse to the FBT (which will be discussed in the next section), FBT and the Half-wave rectifier circuit for each supply line.

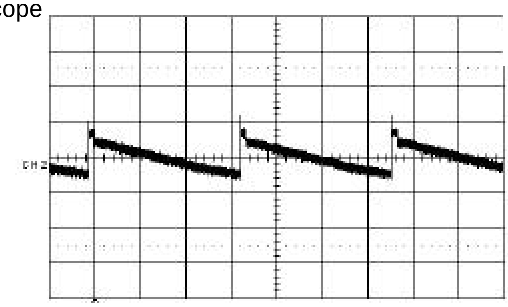
Next, **check the drive signals (DR+ and DR-)** to IC545/pins 1 and 7. Waveforms 4-6 and 4-7 illustrate how the signals should appear at IC545/pins 1 and 7 (confirm amplitude and frequency). If these signals are missing, check the output pins on IC001/pins 44 and 45. These signals should look the same as Waveforms 4-6 and 4-7 with an amplitude difference. If the drive signals are not present at IC001/pins 44 and 45, check the power sources (5V and 3.3V) and crystal X001 (8MHz) on OneChip IC001.

Oscilloscope
Settings:
0.5V
5ms



IC545/Pin 1(Vertical& Ramp Drive Signal
from IC001)
Waveform 4-6

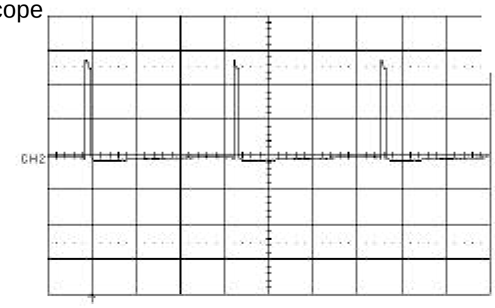
Oscilloscope
Settings:
0.5V
5ms



IC545/Pin 7 (Vertical & Ramp Drive Signal
from IC001)
Waveform 4-7

If the drive signals check OK, **check the signal output on IC545/pin 3 (Ref. Signal)**. This signal should appear as shown in Waveform 4-8. This pulse is used to tell the system control in IC001/pin 78 that the vertical drive is working properly. Also, confirm that this signal is reaching IC001/pin 78. If this signal is missing or distorted at IC545/pin 3, then replace IC545.

Oscilloscope Settings:
10V
5ms



IC545/Pin 3 (Vertical Reference Signal)
Waveform 4-8

Horizontal Deflection and Pincushion Circuits

Note: Reference Figure 4-3 during troubleshooting descriptions.

Overview

The subject of this section will be horizontal circuit troubleshooting tips. The Standby/Timer LED may flash in groups of two or four depending on the type of failure in the horizontal circuit.

Horizontal Deflection Circuit

Horizontal Failure conditions: (reference Figure4-3)

1) **Shorted Output transistors (Q505 or Q506):** Standby/Timer LED will flash in groups of two. Shorted Output transistors will cause a shorted B+ line. System Control detects a B+ Over Current condition.
2) **Open Output transistors (Q505 or Q506):** Standby/Timer LED will flash in groups of four. The Open Output transistors cause no HD to the FBT; which causes no +/- 13V supply output. In turn, this causes no vertical drive (IC545) output. System control detects a “No Vertical drive” condition.
3) **Excessive Horizontal Output Drive (OVP HV):** Standby/Timer LED will flash in groups of four. Because of the excessive HD, the FBT will be over-driven causing excessive secondary voltages. This includes High Voltage (HV) and the +/- 13V outputs. FBT/pin 7 is monitored by IC561 for excessive voltage (this will be discussed in Protection Circuit section). This voltage is proportional to the HV. So, System Control detects an excessive HV condition.

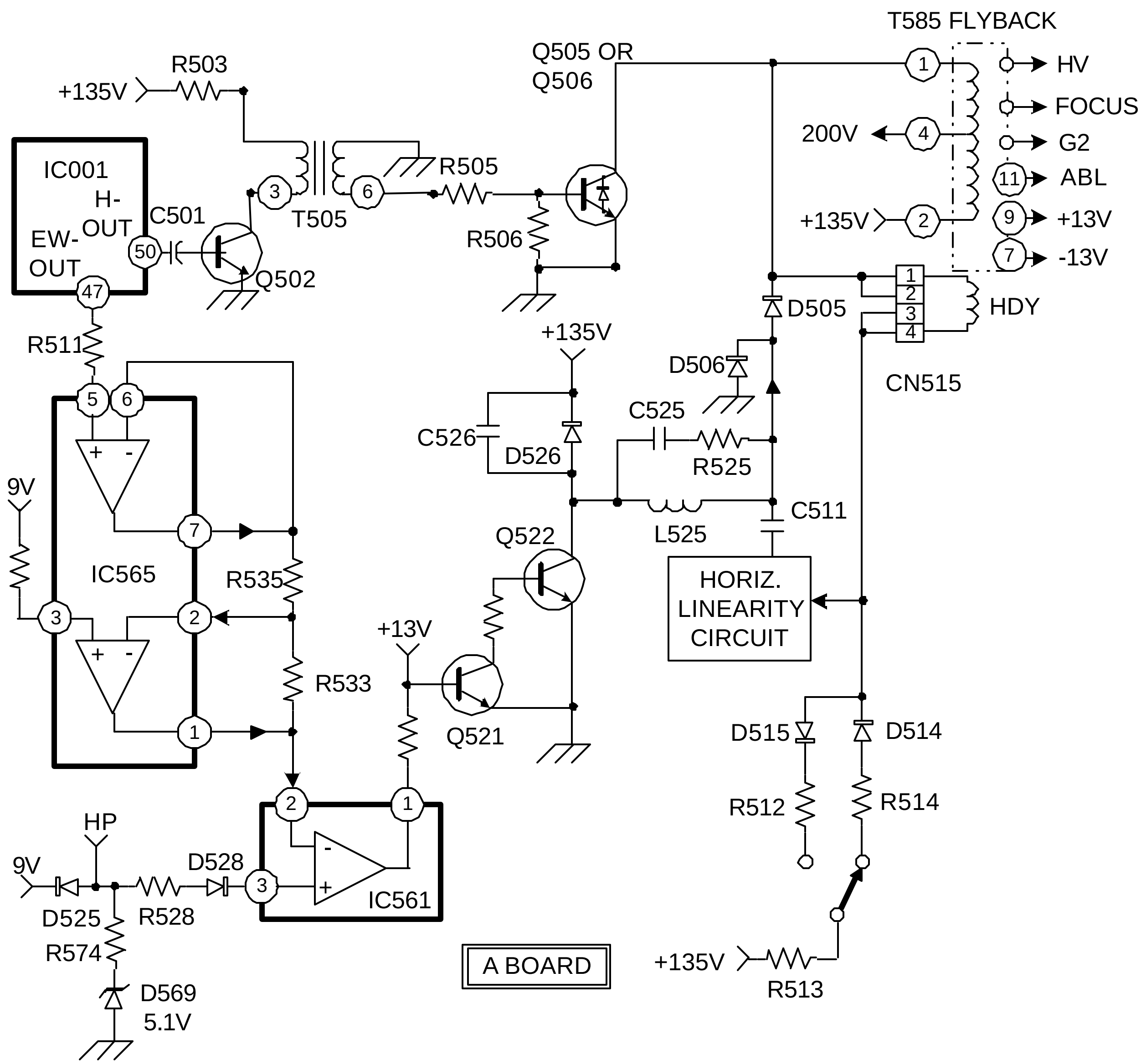


FIGURE 4-3 - HORIZONTAL DEFLECTION CIRCUIT

M-Board

The M-board varies the H-pulse (ref. waveform 4-9) width from IC001/pin 50 depending on the level of the ABL voltage feedback from the FBT/pin 11 to the M-board (CN302/pin 2). This will adjust the H-drive to the FBT to supply more current during sudden bright scenes. When a sudden bright scene occurs, there is an increase in current draw through the FBT; the ABL voltage will increase in direct proportion to the increase in current draw. The M-board senses the ABL voltage (ABL-IN) increase and increases the H-pulse width (CN302/pin 4; H-OUT) to drive the FBT harder and more current is supplied to the picture tube.

M-Board Test:

Place oscilloscope probe on CN302/pin 4 (H-OUT) and switch the video input between Color Bars and Cross Hatch displays; a small change in H-pulse width can be observed.

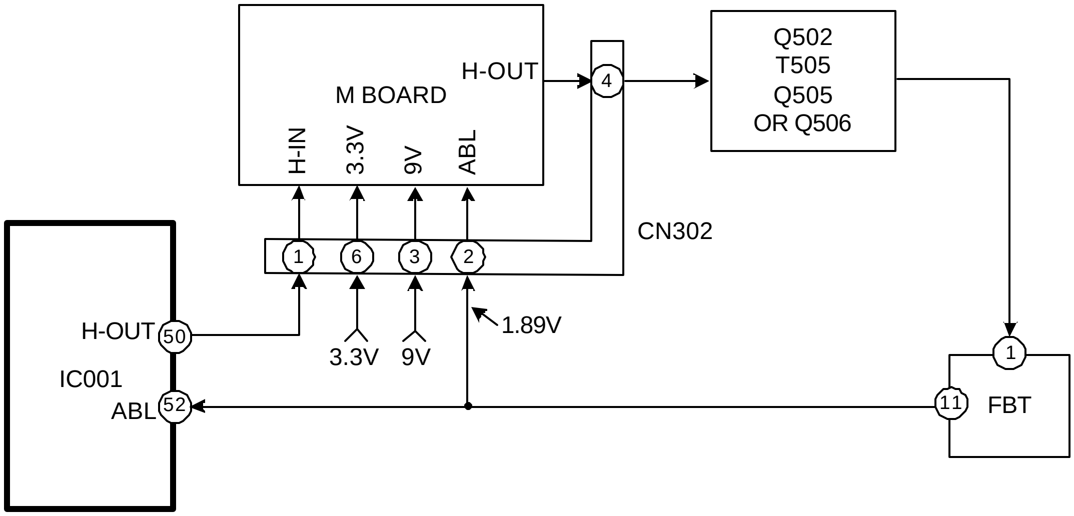
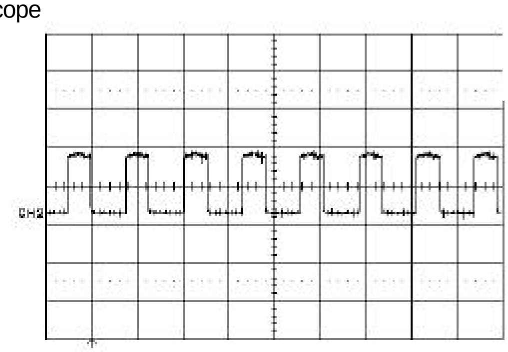


FIGURE 4-4 - M BOARD CONNECTIONS

Troubleshooting

NOTE: The presence of HV for even a short time is an indication that the horizontal circuit is functioning properly and the problem is in the vertical deflection circuit.

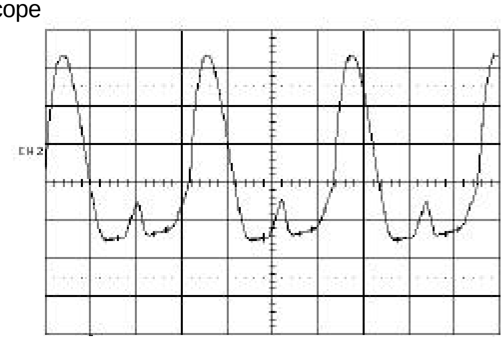
Oscilloscope Settings:
2V
5ms



IC001/Pin 50 (HD Pulse)
Waveform 4-9

As long as there is power to the One Chip IC001, the **Horizontal Drive pulse (HD)** should be output on IC001/ pin 50. This waveform is illustrated in Waveform 4-9. The HD is then applied to the base of Q502. If HD is present at the base of Q502 but not at the collector, then **unsolder R505** located in the base circuit of Q505/ 506.Recheck waveform at the collector of Q502 (reference Waveform 4-10). This will unload the collector Q502 safely and enable Q502 to function properly if there is a defective horizontal output circuit. This also checks **T501**'s ability to couple the signal to Q505/506 (check for Waveform 4-10 at T501/pin 6). Note that if HD is present at the output of T501 (unloaded condition), then **B+ must also be OK** because it is the collector voltage for Q502.

Oscilloscope Settings:
2V
5ms



Q502 Collector and T501/Pin 6
(R505 Unsoldered)
Waveform 4-10

If all the above tests are passed then either the **Horizontal Output transistor** or the **FBT** is defective. The Horizontal Output transistor can be checked using an Ohmmeter. The Base-Emitter junction should check the same as a normal BJT. When checking the Collector-Emitter junction, note that a diode is connected in parallel (the C-E junction will test the same as the B-E junction).

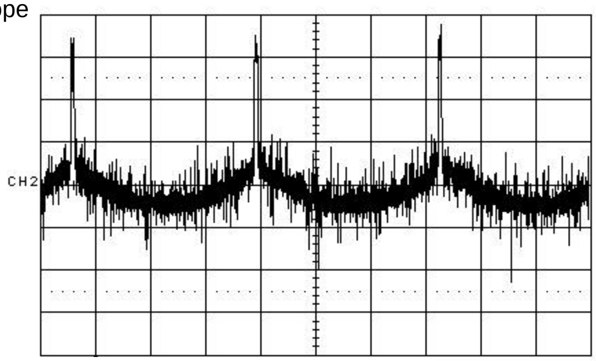
If Q505 or 506 checks OK then replace the FBT.

NOTE: The amplitude of the HD at the collector of Q505 or Q506 is approximately 1000V. If attempting to make a measurement at this point, use a X10 probe and make sure the oscilloscope can handle the power at its input.

Pincushion Circuit (reference Figure 4-3)

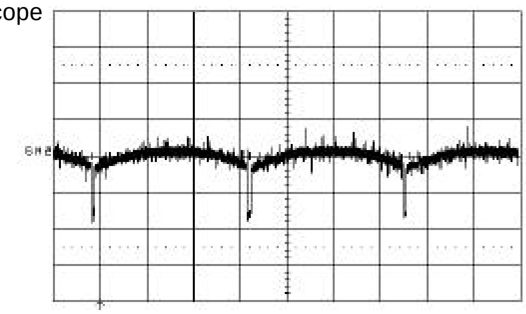
An inverted parabola waveform is used to control the amount of drive current supplied to the FBT to compensate for the pincushion distortion. The E/W signal (inverted parabola) is output on IC001/pin 47 (ref. Waveform 4-1) and passes through Buffer/Amp IC565/pin 5 to IC565/pin 1 (ref. Waveform 4-2). The signal is then applied to gating circuit IC561/pin2 and the HD pulse on IC561/pin 3 (ref. Waveform 4-3) is used to gate the parabola waveform through at the horizontal rate. The resultant signal is output on IC561/pin 1 is amplified by Q521 and Q522. The output signal of Q522 is applied to the anode of D505 (ref. Waveform 4-4) and controls the conduction of D505. Depending on the level of conduction of D505, the current supplied to the FBT will increase or decrease.

Oscilloscope Settings:
0.2V
5ms



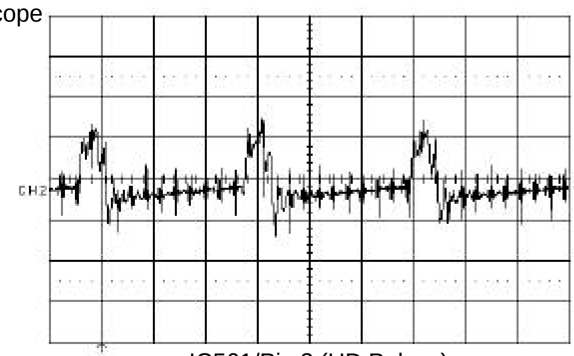
IC001/Pin 47 (Inverted Parabola)
Waveform 4-1

Oscilloscope Settings:
0.5V
5ms



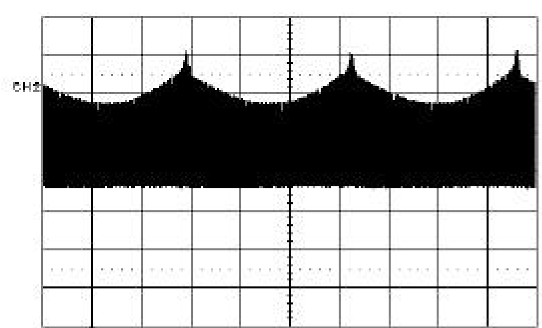
IC565/Pin 1 (Parabola)
Waveform 4-2

Oscilloscope Settings:
0.1V
20ms



IC561/Pin 3 (HD Pulses)
Waveform 4-3

Oscilloscope Settings:
50V
5ms



D505 Anode (Inverted Parabola)
Waveform 4-4

Troubleshooting

1) **Symptom:** Picture is compressed horizontally with Pincushion distortion

   Check: a) Missing HP on IC561/pin 3

   b) Missing complete pincushion waveform at anode D505 (Trace from IC561/pin 1 to D505 anode)

   c) D505 or D506 open circuit

2) **Symptom:** Picture expanded horizontally with Pincushion distortion.

   Check: Missing Parabola waveform (Trace signal from IC001/pin 47 through IC565/pin 5 to 7, and then to IC561/pin 2)

3) **Symptom:** Picture slightly compressed with No Pincushion distortion

   Check: C525 and R525

Chapter 5 - Protection Circuits

Overview

Note: Reference figure 5-1 during the following overview discussion:

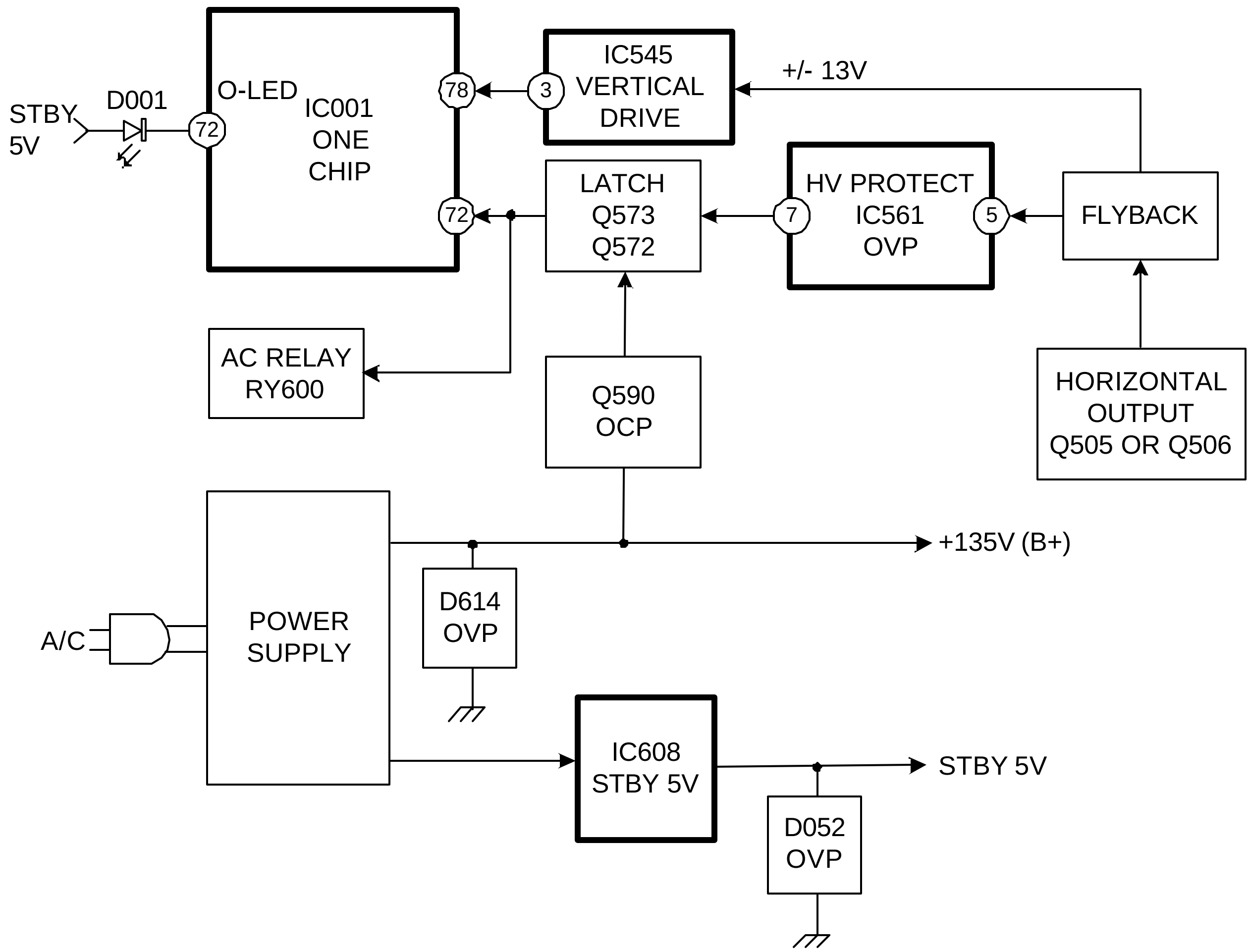


FIGURE 5-1 - PROTECTION BLOCK

In this section, the protection circuits contained on the BA-6 chassis will be discussed. Table 5-1 below is a quick reference that shows how each protection circuit affects the BA-6 chassis when activated.

Table 5-1 – Protection Circuits at a Glance

Monitored Circuit	Monitored Parameter	Affected Circuit	Circuit Used to Shut-Off AC relay
+135V Line	OCP	• -AC Relay (OFF) • -I-HLDWN (IC001/pin 72)	Latch Q572 and Q573
+135 Line	OVP	• AC Relay (OFF) • D614 • I-PROT (IC001/pin 78)	IC001/pin 66
Vertical Deflection	No output signal (IC545/pins 1 & 7)	• AC Relay (OFF) • I-PROT (IC001/pin 78)	IC001/pin 66
Horizontal Deflection	No output signal (Q505/506)	• AC Relay (OFF) • I-PROT (IC001/pin 78)	IC001/pin 66
5V Standby voltage	OVP	D052 (Shorted)	No Power ON function
HV	Excessive Voltage	• -AC Relay (OFF) • I-HLDWN (IC001/pin 72)	Latch Q572 and Q573
IC600/pin 8	OVP, OCP, UVP	• AC Relay (OFF) • I-PROT (IC001/pin 78)	IC001/pin 66
Q600/Q601	OCP	• AC Relay (OFF) • I-PROT (IC001/pin 78)	IC001/pin 66

NOTE:

- If the protection mode is activated from the Latch Circuit, then the unit must be unplugged from the AC Outlet and reconnected to RESET.
- If the protection mode is activated from IC001/pin 66, the unit only needs to be turned OFF and then ON from the remote or front panel to RESET

The **protection circuits for IC600** (Power Supply Switching IC), and Q600 and Q601 (Power Supply Switching FETS) have already been covered in Chapter 3 (Power Supply Circuits). Reference this chapter for the theory of operation for these protection circuits. They will not be discussed in this section.

The **Vertical and Horizontal protection circuits** were briefly mentioned in Chapter 4 (Deflection Circuits) in their respective troubleshooting sections. The circuit theory of their operation will be discussed in this section. Reference Chapter 4 for troubleshooting tips concerning these circuits.

The **Standby 5V supply** is protected for over-voltage using zener diode D052. If the voltage increases above 5.6V, D052 will break down and regulate at 5.6V.

NOTE: There are many zener diodes (OVP) connected to various inputs on the One Chip IC001. Not all of these OVP zener diodes will be discussed. Just be aware that they are present in the circuit. So, when a voltage or signal is found to be low or missing, you should check to see if an OVP zener diode is connected to that input.

Protection Circuits

The four main functions monitored by the protection circuits are the Vertical deflection, Horizontal deflection, High Voltage (HV) and +135V supply (Ref. Figure 5-1 for block diagram and Figure 5-2 for circuit detail).

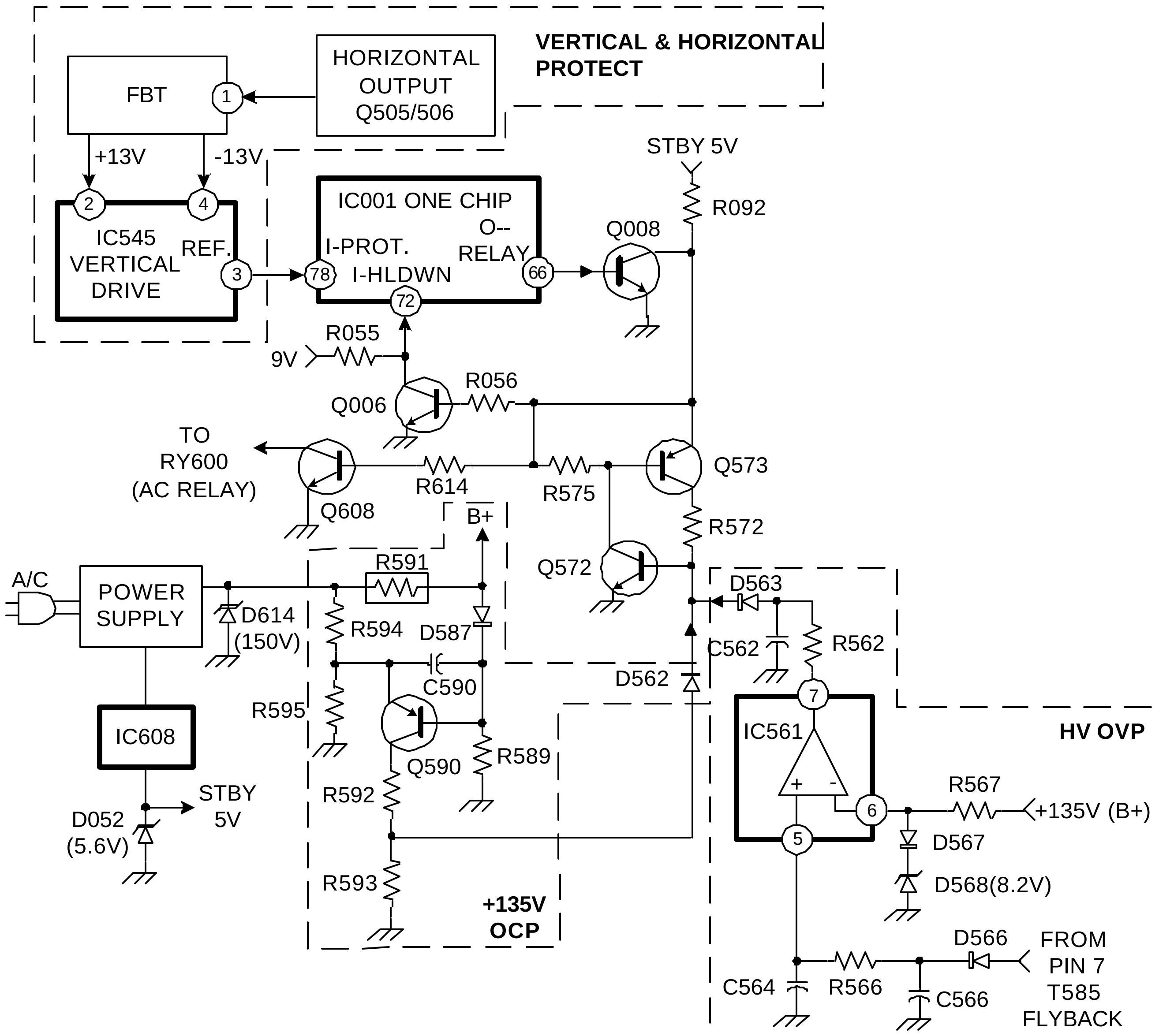


FIGURE 5-2 - PROTECTION CIRCUIT 5.2CTV30 1437 4/2/02

Vertical and Horizontal Deflection

Note: Reference Figure 5-2 during the following discussion:

The Vertical and Horizontal deflection circuit outputs are both monitored by the same circuit. If the vertical deflection circuit fails, IC545/pin 3 will stop outputting pulses to IC001/78. IC001 will detect an absence of input pulses and place the unit into protection mode by outputting a HIGH at IC001/pin 66 and turning ON Q008. Q008 then applies a ground to the base of Q608, causing Q608 to turn OFF and remove the ground from AC Relay (RY600). RY600 turns OFF and the unit goes into Standby Mode. This same circuit indirectly monitors a failure in the horizontal output circuit. The main thing to notice here is that the Vertical drive IC545 gets its supply voltages from the FBT (+/- 13V). The FBT is driven by the HD pulse from output transistor package Q505/506. If there is no horizontal output, then there will be no drive signal to the FB and no +/- 13V developed on the

secondary of the FBT. With the +/- 13V missing, IC545 will not function and IC001 will detect a vertical failure and place the unit into protection mode.

+135 Supply (OVP and OCP)

Note: Reference Figure 5-2 during the following discussion:

The **+135V supply OVP** is simply zener diode D614. If +135V line rises above 150V, D614 will break down and regulate the voltage at 150V. Most likely D614 will be destroyed (shorted circuit) and short the +135V to ground. **Note:** D614 is physically connected prior to the OCP circuit (Q590). So, when D614 shorts, all current is sent through D614. The OCP is not triggered. System Control in IC001 detects a vertical circuit failure due to the following sequence of events:

Follow the order of events as shown below:

1) +135V is missing
2) +135V is supply voltage to FBT and Horizontal Output transistor
3) No drive to FBT
4) No +/- 13V developed on FBT secondary
5) +/- 13V is supply to IC545 (Vertical drive IC)
6) No Vertical drive output
7) IC001 detects vertical failure

The **+135V supply OCP** is monitored using Q590, R591 and associated circuitry. The current draw on the +135V line flows through voltage divider R594 and R595 series resistor R591. If the current rises on the +135V line, so will the voltage drop across R591. When the current is great enough to cause the voltage drop across R591 to be approximately 1.2V, Q590 will turn ON. Current will now flow through voltage divider R592 and R593. Once the voltage drop across R592 reaches 1.2V, D562 and 0.6V will be applied to latching transistor Q572.

The **Latch circuit (Q572 and Q573)** operates in the following manner: Q572 is forward biased by applying 0.6V to its base circuit. Q572 then saturates and passes ground to the base circuit of Q573. Q573 turns ON (once the Latch is activated, it will remain in this state until the unit is unplugged from AC power and reconnected). The voltage at the base circuits of Q006 and Q608 is reduced below turn-on (0.6V). Q006 shuts off and a High is applied through R055 to IC001/pin 72 (I-HLDWN). Q608 is simultaneously shut off, which removes the ground return to the AC relay (RY600). AC power to the Main Switching Power Supply is disconnected and the unit is placed into **Standby Mode**. The High at IC001/pin 72 (I-HLDWN) activates the self-diagnostics and the **Standby/ Timer LED flashes in groups of TWO.**

High Voltage (OVP)

Note: Reference Figure 5-2 during the following discussion:

The **HV (OVP)** monitoring circuit will also trigger the Latch circuit (Q572 and Q573). The condition of the High Voltage (HV) is continuously checked by monitoring FBT/pin 7 secondary AC voltage (not shown). This Ac voltage is fed to a half-wave rectifier circuit D566 and C566. The resulting DC voltage is then applied to IC561/ pin 5. This voltage is proportional the HV and will follow if HV increases. The voltage at IC561/pin 5 is compared to the reference voltage (10.3Vdc) on IC561/pin 6. The reference voltage 10.3V is developed from +135V using regulator circuit consisting of D568, D567 and R567. A High will be output on IC561/pin 7 when the voltage on IC561/pin 5 rises above the reference voltage on IC561/pin 6. This high will activate the Latch circuit as described in the previous paragraph. Once again, the unit is placed in **Standby Mode** and the **Standby LED Flashes in groups of TWO**.

Chapter 6 - Video/RGB

Overview

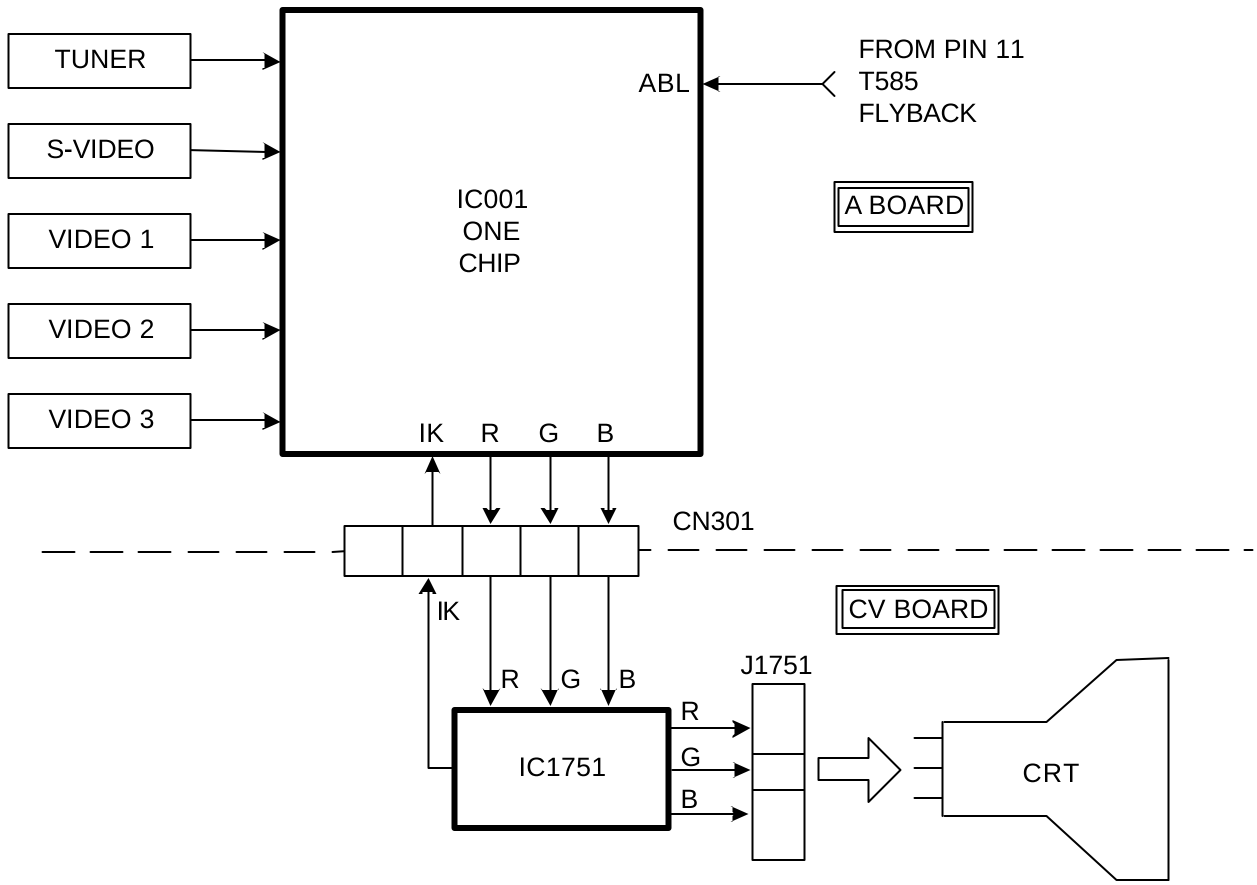


FIGURE 6-1 - VIDEO / RGB BLOCK 6.1CTV30 2/27/02

Note: Reference Figure 6-1 during the following discussion:

All video source inputs (Tuner, S-Video and Video 1, 2, 3) are connected directly to the "OneChip" IC001. IC001 performs all video input switching and processing internally. The Comb Filter processing (Y/C separation) for composite video inputs (Tuner, Video 1, 2, 3) to create RGB is performed inside IC001.

Further RGB processing is performed on the CV board and then applied to the CRT through J1751 for display. IK pulses are sent back from the CV board to IC001 on the A board for each color cathode current check.

Video/RGB

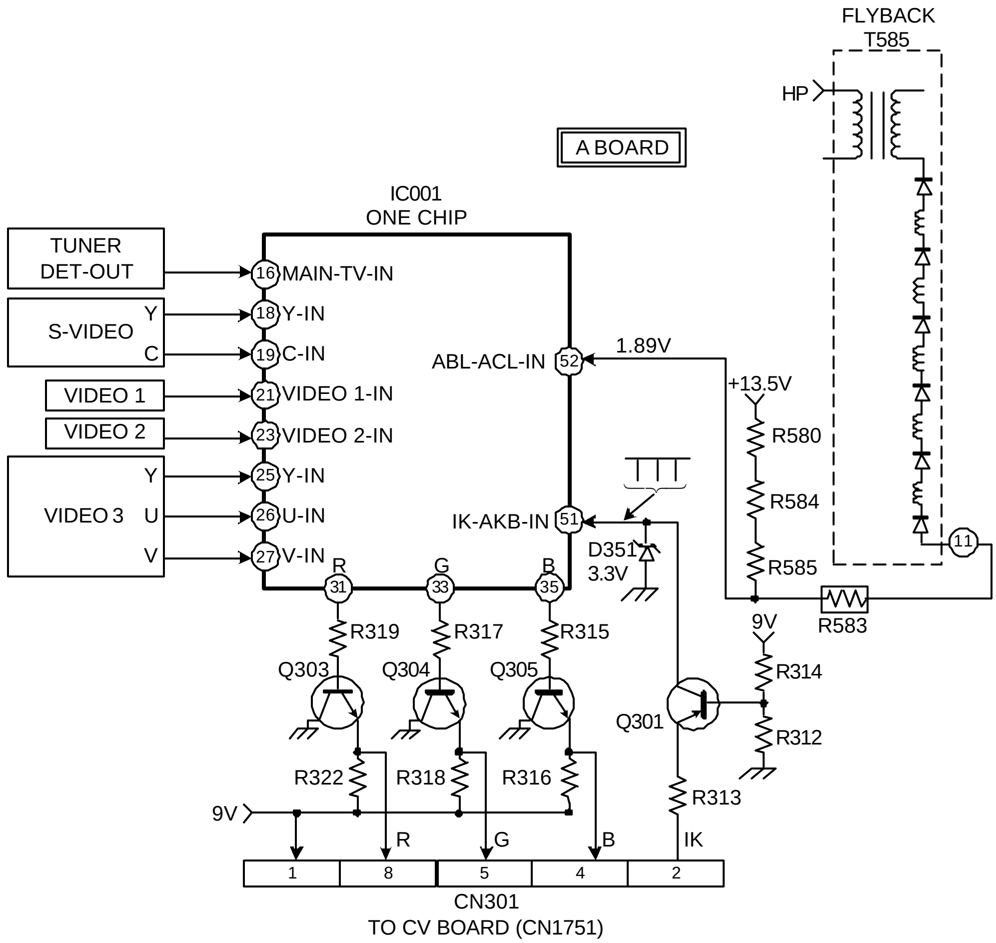
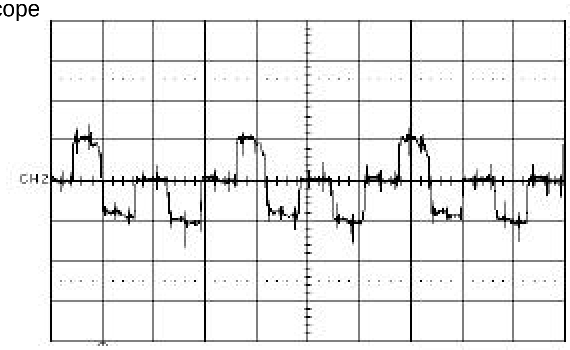


FIGURE 6-2 - VIDEO CIRCUIT

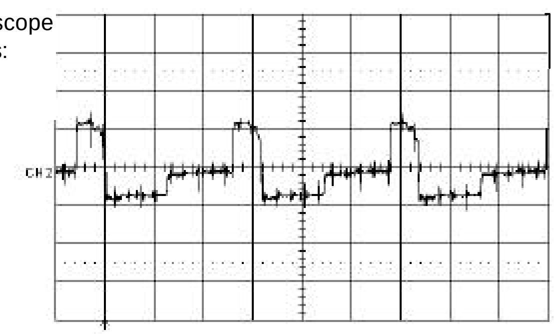
6.2CTV30 3/27/02

Oscilloscope
Settings:
0.5V
20 µs



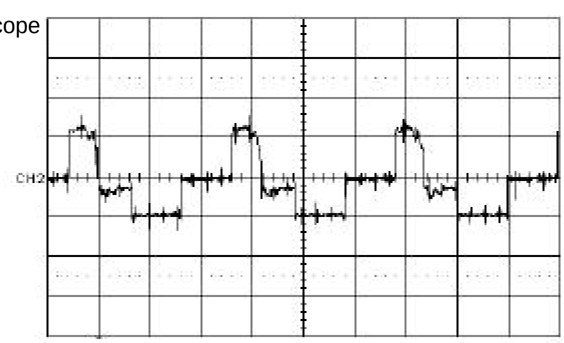
IC001/Pin 31 -Red Component Signal
Waveform 6-1

Oscilloscope
Settings:
0.5V
20 µs



IC001/Pin 33 - Green Component Signal
Waveform 6-2

Oscilloscope
Settings:
0.5V
20 µs



IC001/Pin 35 - Blue Component Signal

Note: Reference Figures 6-2 and 6-3 during the following discussion:

A more detailed diagram of the Video and RGB path is shown in Figure 6-2. The video source is input directly to IC001 on the designated input port. IC001 performs all video processing internally and outputs RGB on IC001/ pins 31, 33 and 35 respectively (ref. Waveforms 6-1, 6-2, and 6-3). The RGB is buffered by Q303, Q304 and Q305 before being sent to the CV board through CN301.

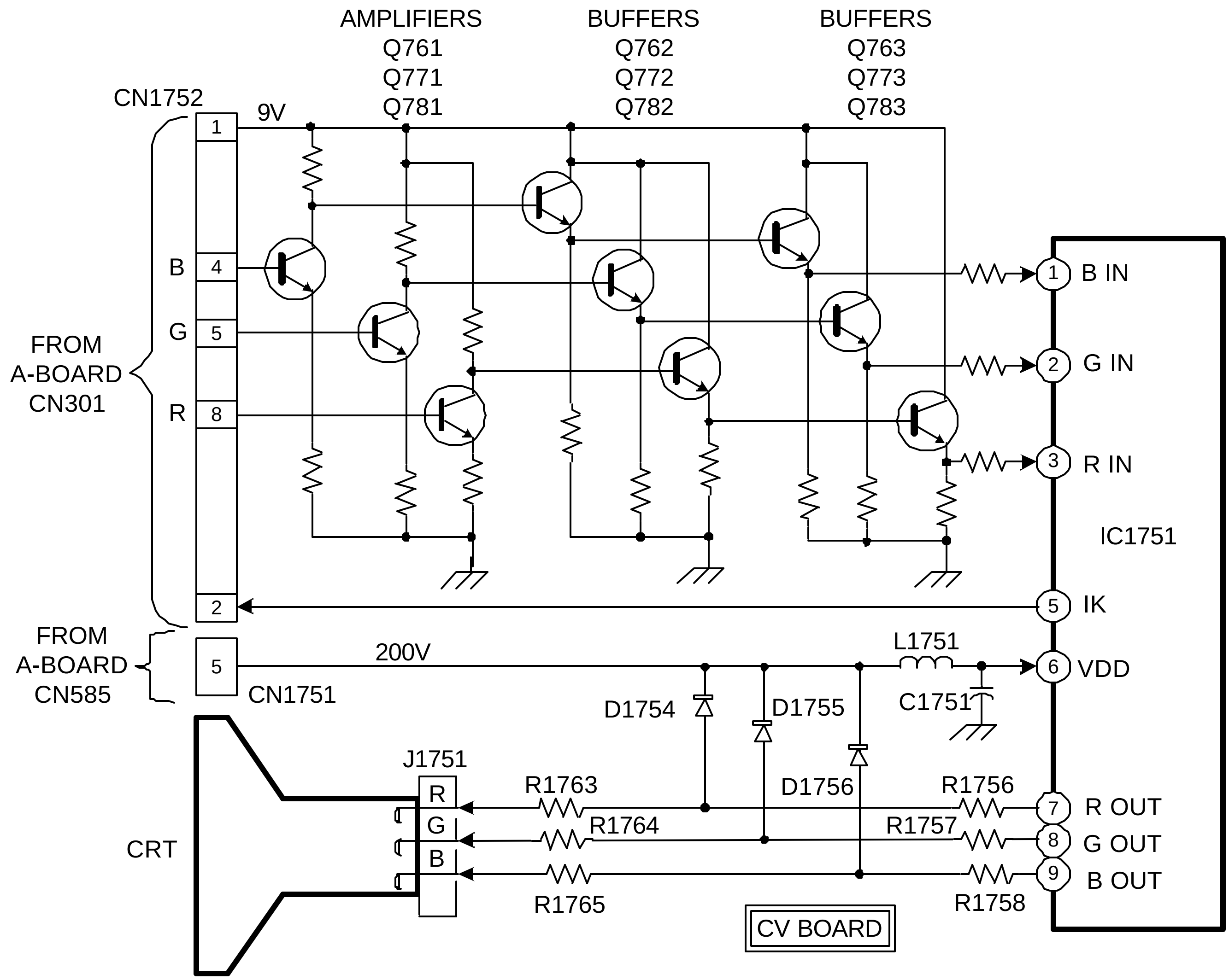


FIGURE 6-3 - RGB DRIVE 6.3CTV30 1440 3/28/02

The RGB signals are first amplified by transistors Q761, Q771 and Q781 (ref. Figure 6-3); then pass through two transistor buffer banks (Q762; Q772; Q782 and Q763; Q773; Q783) on the CV board (ref. Figure 6-3). The amplified and buffered RGB signal is then applied to the RGB Driver IC1751/pins 1, 2 and 3. The CRT receives RGB final drive signals from outputs at IC1751/pins 7, 8 and 9.

The two input signals (ref. Figure 6-2) IC001/pin 52 (ABL) and IC001/pin 51 (IK-AKB) are used to adjust the levels at the RGB outputs (IC001/pins 31, 33 and 35), depending on certain picture tube conditions.

The **Automatic Brightness Limiting (ABL)** input monitors the current drawn by the picture tube's High Voltage. If the picture gets suddenly bright, the ABL voltage input to IC001/pin 52 causes a reduction in the R, G and B output levels.

IK Pulse Waveform Diagrams

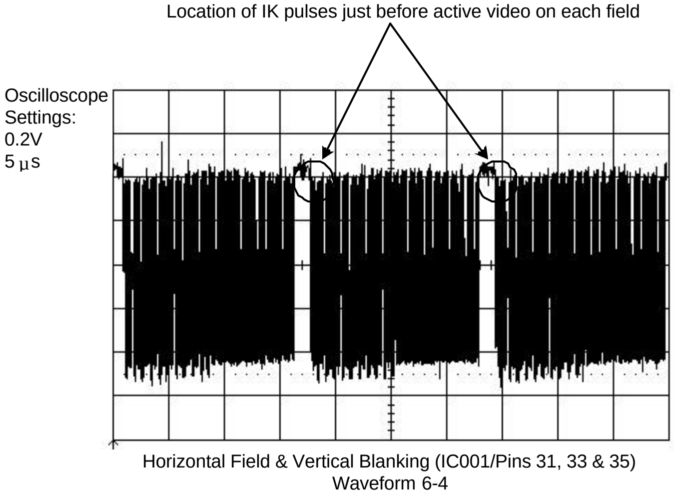
NOTE: Waveforms 6-4, 6-5, 6-6, 6-7, and 6-8 are a sequence of pictures illustrating where the IK are found, and how they appear on an oscilloscope display. Reference these Waveforms during the following IK_AKB circuit description. Note: Use IC545/pin 3 to trigger oscilloscope and lock signal on the display. All oscilloscope settings are where taken using a X10 probe

The Waveform sequence description is as follows:

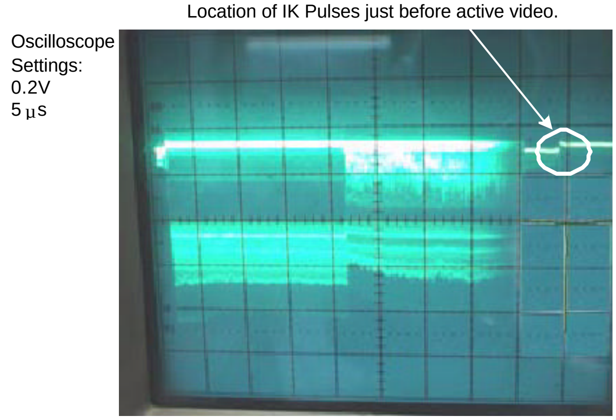
1) Waveform 6-4 shows the oscilloscope time-base starting point at the field rate. The IK pulse and IK Feedback pulses occur during the vertical blanking areas. These areas are shown as gaps between each field.
2) Waveform 6-5 is an expanded view of Waveform 6-4 showing one field and one vertical blanking area.
3) Waveform 6-6 is an expanded view of Waveform 6-4 showing the IK pulses to the CRT's from IC001/pins 31, 33, and 35. These pulses are located in the vertical blanking area just before active video. Two consecutive pulses at a flat video level (or brightness level) can be seen.
4) Waveform 6-7 is a further expansion of Waveform 6-4, showing the IK Feedback pulses (IC1751/pin 5) in the vertical blanking area just before active video (one field). Three small consecutive IK feedback pulses can be seen.
5) Waveform 6-8 is a close-up shot of the IK feedback pulses.

Also shown in Figures 6-2 and 6-3 is the **IK_AKB signal** path. The purpose of the IK signal and AKB circuit is to monitor and adjust the cathode bias on CRT's (Red, Green and Blue) for optimal white balance. The IK pulses are output from IC001/pins 31, 33 and 35 (RGB Drive signals) initially when the unit is turned ON, and then repeated for each field thereafter (reference Waveform 6-6). The pulses are output during the over-scan (or vertical blanking) portion of the picture, so they are not visible on the picture tube. The IK pulses are shown in Waveform 6-6 as two flat video levels just before active video. These pulses are sent to their respective color cathode in a staggered order with red first, then green and blue to drive the tube at a flat raster level. They follow the same path as the RGB signal described in the previous paragraph.

Once the IK cathode drive pulses are applied to each color cathode in sequence (red-green-blue), IC1751/pin 5 outputs a corresponding IK Feedback pulse proportional to the current draw of each cathode (feedback pulses shown in Waveform 6-7). The IK feedback pulses are sent through CN1752/pin 2 and applied to buffer transistor Q301. After buffer Q301, the IK feedback pulses are input to IC001/pin 51 and evaluated by the internal AKB circuit. The AKB circuit determines if the drive to the cathodes needs to be adjusted for optimal white balance, or if one of the CRT's is defective (No feedback pulse). The IK-AKB input IC001/pin 51 is also level protected using D351 (3.3V).



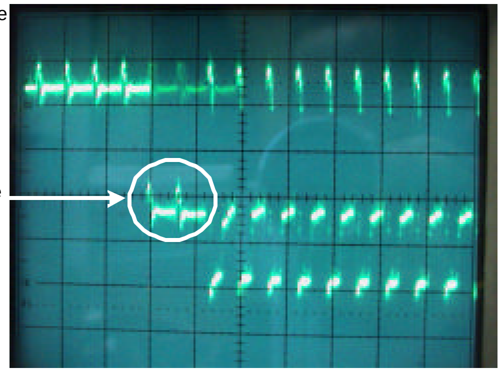
Horizontal Field & Vertical Blanking (IC001/Pins 31, 33 & 35)
Waveform 6-4



One Horizontal Field and Vertical Blanking
(IC001/Pins 31, 33 & 35)
Waveform 6-5

Oscilloscope Settings:
0.2V
2 µs

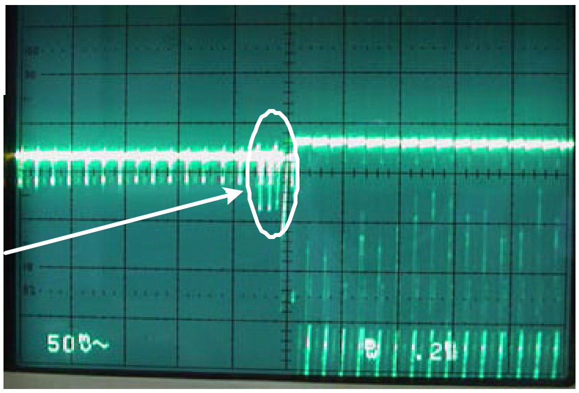
CRT Drive Pulse



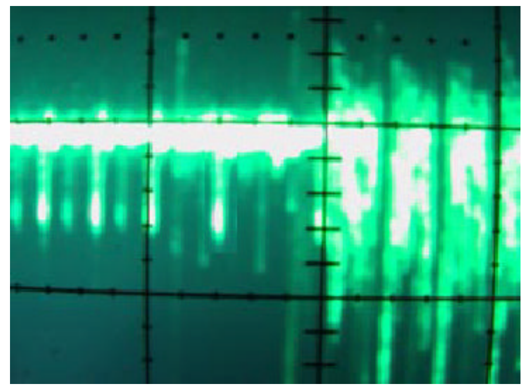
IK Pulses to CRTs (IC001/Pins 31, 33 & 35)
Waveform 6-6

Oscilloscope Settings:
0.5V
0.2 µs

IK Feedback Pulses



IK Feedback Pulses in Vertical Blanking (CN301/Pin 2)
Waveform 6-7



Closeup of IK Feedback Pulses
Waveform 6-8

Troubleshooting

NOTE: Presently the IK-AKB circuit Video Blanking and Standby/Timer LED 5 flash sequence indication functions have been bypassed in this **first version** of the One Chip (IC001). Instead, the video is passed to the CRT so that any problem in the IK-AKB circuit can be viewed. The problems described below can be quickly diagnosed by observing the condition of the video present on the CRT and the voltages as described can be used to confirm a defect.

The IK-AKB circuit indication function as described in the service manual will be implemented in the **second version** of IC001.

The following three possible IK-AKB circuit failures and the circuit operation descriptions during these failures are for the present **first version** IK-AKB circuit. These descriptions will apply to the **second version** of IC001 **except for: 1) the Video will be Blanked; and 2) the Standby/Timer LED will flash in groups of five in the second version IC001.**

Failures and Circuit/Unit Operation During Failure:

1) **Failure**: The picture tube is old (one or more cathodes are weak) and the amplitude of the IK feedback pulses is too low to perform automatic cathode adjustment (Replace Picture Tube).

Circuit Operation: If the IK-AKB circuit cannot compensate for the weakened state of the cathode, **video can still be viewed on the CRT with the defective cathode color missing**. To confirm that the tube is defective, check the voltages on the individual cathodes.

In normal operation with video (color bars) applied, the voltages at the cathodes should be as follows:

KR = 150V

KG = 150V

KB = 150V

If there is a defective cathode, the voltage at that cathode will be less then 130V. For the extreme case of an open cathode, the voltage will be 116V. The other good cathode voltages will be normal at 150V. What's happening is the IK-AKB circuit is trying to compensate for the defective cathode by driving it harder (116V) then the other cathodes (150V). If this voltage variation appears on one or more cathodes, suspect a defective cathode, and thus a defective tube.

Also, check the IK Feedback pulse at IC545/pin 5 (ref. Waveform 6-7) one pulse will be completely missing.

Failure: One or more of the IK Drive pulses is not output from IC001/pins 31, 33 and 35 to the CRT.

Circuit Operation: The video (color bars) will appear on the picture tube with one or more colors missing. Check for the Video and IK Drive Pulses at IC001/pins 31, 33, 35 Video and pulses should appear as shown in Waveform 6-6. Most likely, the output will be completely missing Video and IK Drive Pulses. A defective IC001 or Open in path from IC001 to IC1751 to the CRT can be confirmed by checking the voltages on each cathode (CV board). The voltages on the good cathodes with drive will be normal at 150V; the cathode with no drive pulse will be ~175V.

Failure: The IK Feedback pulses are not returned to IC001/pin 51 from IC1751/pin 5 (open return path or defective IC1751).

Circuit Operation: The video (color bars) will appear washed-out on the picture tube (bright white halo throughout picture). If IC001/pin 51 does not receive the IK Feedback pulses from IC1751/pin 5, then IC001 will detect three defective cathodes. The voltage measured at each cathode will be 120V. IC001/pins 31, 33 and 35 will output maximum signal level in an attempt to compensate (ref. Waveform 6-6). Check IC1751/pin 5 for IK Feedback Pulses (ref. Waveform 6-7). If these pulses are missing, suspect defective IC1751. If the pulses are present, trace pulses to IC001/pin 51 to find open circuit.

Chapter 7 - Audio

Overview

There are two different audio circuits depending on the model. Table 7-1 indicates which audio IC is used in each model.

Table 7-1		
Model	**Audio Circuit IC's**	**Features**
KV13FS100	IC401 & IC404	Input Switching Only
KV13FS110	IC401& IC404	Input Switching Only
KV20FS100	IC401 & IC404	Input Switching Only
KV20FV300	IC400 & IC404	SRS, WOW, Simulated Stereo and Input Switching
KV24FS100	IC401 & IC404	Input Switching Only
KV24FV300	IC400 & IC404	SRS,WOW, Simulated Stereo and Input Switching

All models use the same power amplifier IC404. The audio processor (IC400, IC401 or IC402) used in the various models depends on the features available; IC400 is installed in Surround Sound models; IC401 is installed in Stereo models. There is a thrid audio IC shown on the schematic; IC402 is installed in Mono models, which are not sold in the US. The following sections will discuss and illustrate each US model audio circuit configuration.

Audio Circuit [KV20FV300 & KV24FV300]

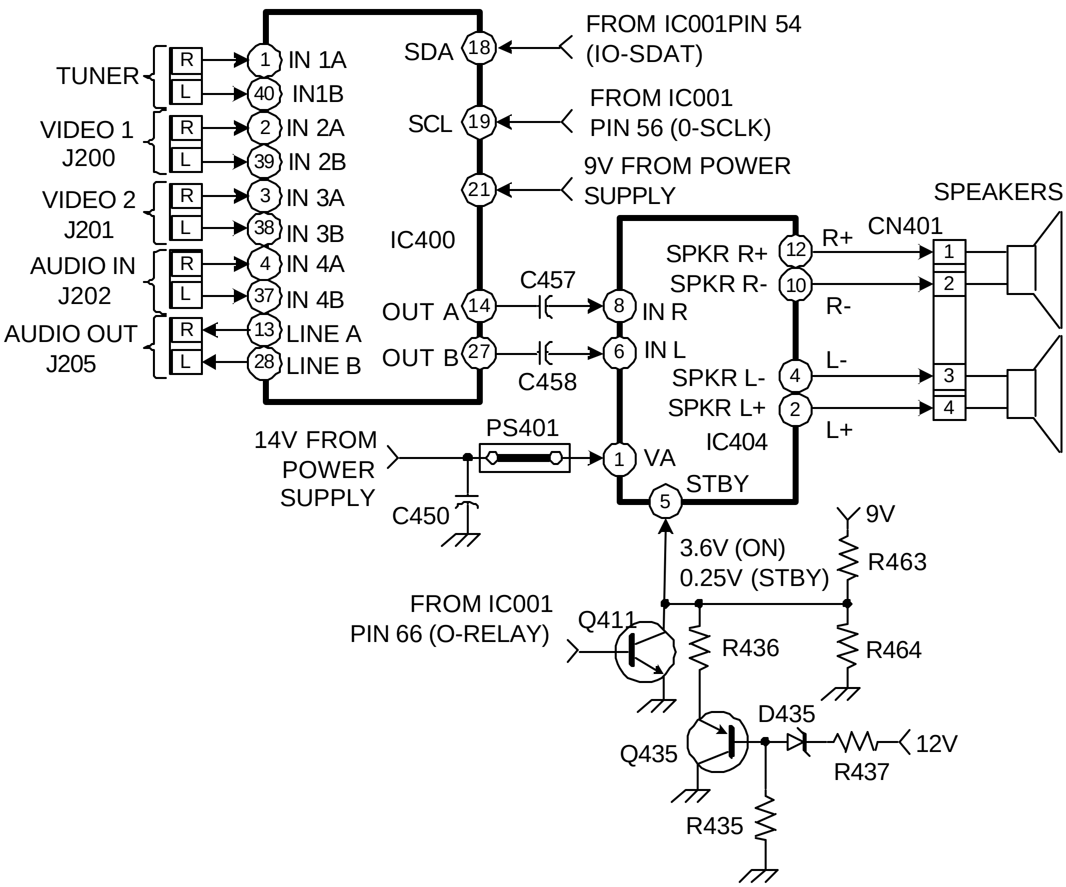


FIGURE 7-1 - AUDIO CIRCUIT (KV-20FV300 & KV-24FV300)

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Figure 7-1 illustrates the audio circuit configuration for models KV-20FV300 and KV-24FV300.

Because these two models have the feature of WOW, SRS and Simulated Stereo, IC400 is installed. The Right and Left inputs from each audio jack and Tuner are connected to IC400 as illustrated in Figure 7-1. All audio functions are performed inside IC400. The following IC400 internal functions are controlled by IC001/pin 54 (IO-DAT); via serial data input IC400/pin 18 (SDA):

- Volume
- Mute
- Input Switching
- Audio Effect modes (WOW, SRS)

Note: There is no volume control on IC404 when IC400 is installed. IC404/pin 9 is used as a redundant muting function only in this configuration.

The selected audio is output at IC400/pins 14 and 27. All "FV" models have an audio output jack on the rear of the set. This audio output is at IC400/pins 13 and 28.

The audio outputs of IC400 are applied to Audio Amplifier IC404/pins 6 and 8. The audio signal is amplified and output on IC404/pins 2, 4, 10 and 12 to the speakers.

IC404/pin 1 receives its power from the 14V supply line and is protected using PS401.

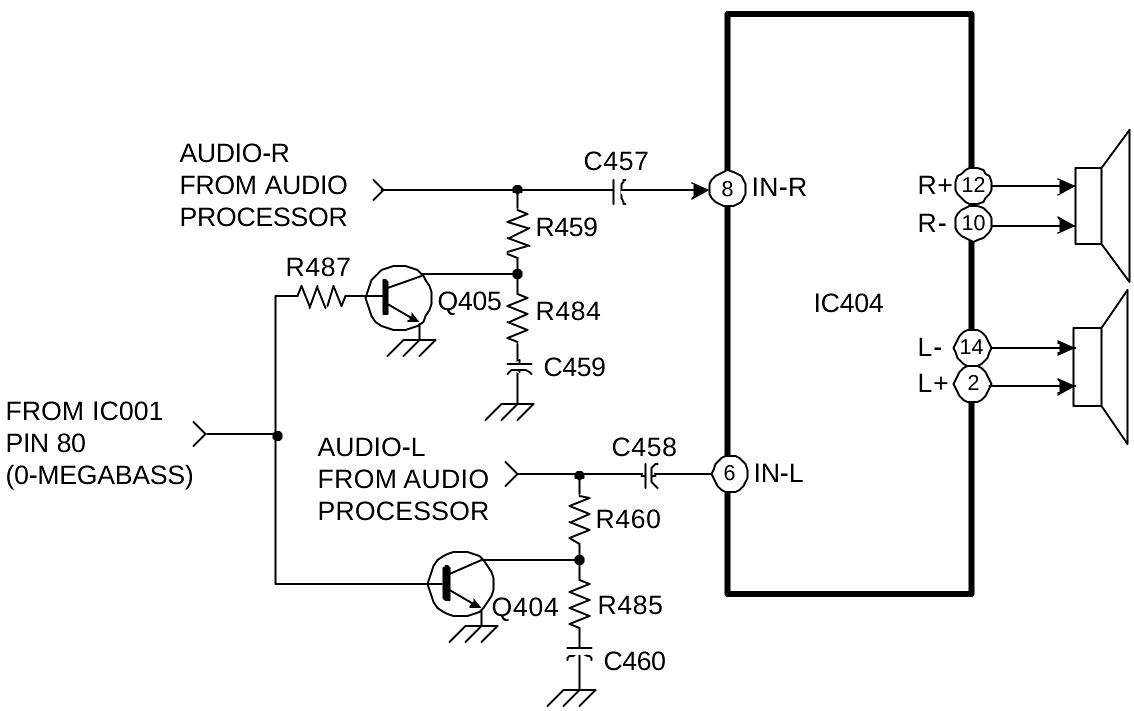


FIGURE 7-2 - AUDIO, "WOW" CIRCUIT 7.2CTV30 3/6/02

Figure 7-2 shows the WOW circuit consisting of Q405, R484, C459 (Left channel); Q404, R485 and C460 (Right channel). This audio sound effect is found in the "FV" models. When activated through the menu, a full, deep bass sound is produced. Along with the WOW effect, BBE is directly activated to further enhance the sound.

In normal operation, IC001/pin 80 (O-MEGABASS) sends a high to the base circuits of Q404 and Q405. The base circuits are tied together so they are both turned ON. With Q405 turned ON, the high pass filter circuit R484 and C459 is bypassed; with Q404 turned ON, the high pass filter circuit R485 and C460 is bypassed. When the WOW effect is turned ON through the menu, IC001/pin 80 sends a Low to turn OFF Q404 and Q405. With Q404 and Q405 turned OFF, the High Pass filters are placed in the circuit and a portion of the high frequency band will sent to ground, thus enhancing the low frequency content of the input audio.

The next diagram (Figure 7-3) shows the audio circuit configuration for the models KV-20FS100, KV-24FS100 and KV-13FS100/110 where IC400 audio processor is not installed. These models use IC401 for stereo audio input switching and IC404 for volume control and audio amplification. IC401/pins 2 and 4 (switching inputs) are controlled using a simple two binary signal from IC001/pins 67 and 68. Table 7-2 shows the state IC401/pins 2 and 4 depending on the input selected.

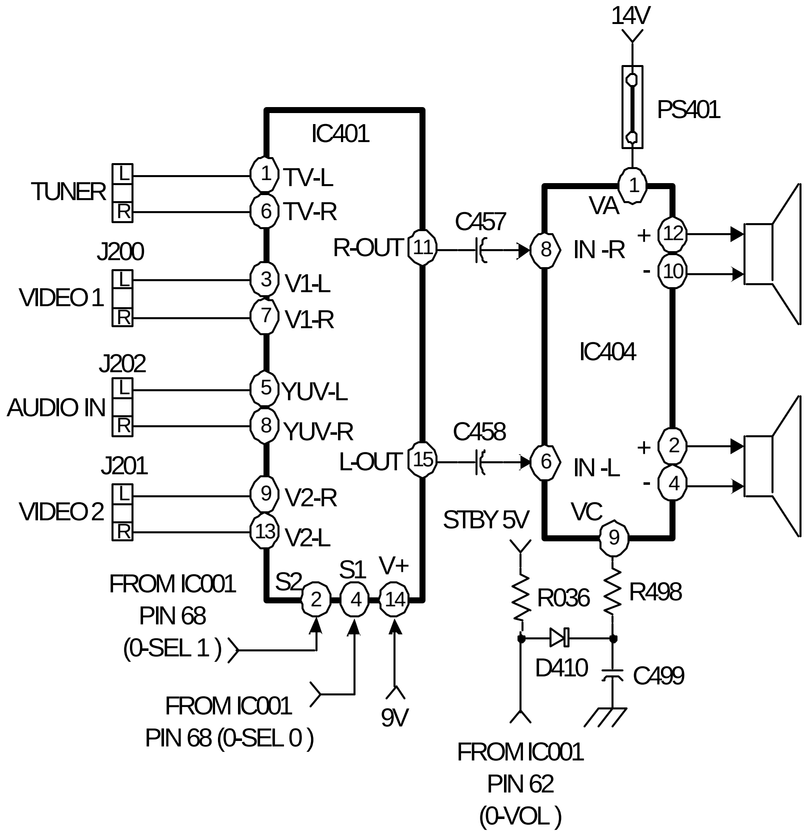


FIGURE 7-3 - AUDIO CIRCUIT [KV-20FS100, KV-24FS100 & KV-13FS100/110]

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Table 7-2 - IC401(IC402)/pins 2 and 4 Input Select States		
Input	**IC401/pin 2 (S2)**	**IC401/pin 4 (S1)**
Tuner (TV)	Low	Low
Video 1	High	Low
Video 2	Low	High
Video 3 (YUV) (IC401 Only)	High	High

DC voltage using D410, C499 and R498. The level of this DC voltage depends on the pulse duration of the PWM signal, which is modified by IC001, and ultimately the user volume setting. The DC is applied to IC404/pin 9 and is finally used to set the audio level output on IC404/pins 2, 4, 10 and 12.

Troubleshooting

No Audio from IC404 (inputs OK): check the following:

- PS401 for open condition
- Voltage at IC404/pin 5 (~3V). If voltage is low or missing check, Q411 and Q435 for shorted condition.
- Voltage at IC404/pin 9. If this voltage goes below 0.5V, the unit will mute. This is true even when IC400 audio processor is installed.
- If all voltages and inputs check OK, replace IC404

No audio output from IC400:

- Check audio input from audio jacks
- Check power supply IC400/pin 21 (9V)
- Check IC400/pin 18 (Data) and IC400/pin 19 (Clock)

  Check for presence of digital signal

No audio output from IC401 (IC402):

- Check audio input from audio jacks
- Check power supply IC401/pin 14 (9V)
- Check power supply IC402/pin 6 (9V)
- Check two bit binary switch pattern IC401 (IC402)/pins 2 and 4. (Ref. Table 7-1)

Chapter 8 - Self-Diagnostics

Power ON

When the unit is plugged into an AC outlet, power is supplied to the Standby Power Supply and the unit is in Standby Mode. The Standby Power Supply powers-up the System Control, EEPROM, IR Remote sensor and Reset circuits (reference Power Supply section for details). If a Power-ON command is received after reset is completed, the System Control outputs command to power-up the rest of the unit. When operating correctly, the following sequence of events should occur:

- The AC power relay clicks.
- One second later the degauss relay clicks and the hum of the DGC can be heard for about two seconds.
- The degauss relay will then click again (turning OFF).
- Picture is displayed.

This entire sequence occurs in the first five to ten seconds the unit is powered ON. During this time, the Standby/ Timer LED will be flashing once per second.

Self-Diagnostic Indication

In the Power Supply, Deflection and Protection sections of this book, a number of failure detection circuits (protection) were discussed. Here is a summary of those circuits:

- IC600/pin9 OCP
- IC600/pin8 OCP, OVP, and UVP
- IC001/pin 72 (+135 OCP, HV OVP)
- IC001/pin 78 (No Vertical deflection, No horizontal Output)

Any one of these defects will activate the self-diagnostics programmed in the unit and depending on the type of failure, the Standby/Timer LED will flash in a designated sequence. Use the Table 8-1 for a quick reference in understanding self-diagnostic indications.

Table 8-1 – Self-Diagnostics

Diagnostic Description	Standby/Timer LED Flash Sequence	Failure History Display	Probable Cause
Power does not turn on	Does not light	N/A	- AC power disconnected - Fuse F601 open
HV OVP (AC relay OFF)	2 times	N/A	- HD output over-driving FBT - FBT defective
+135V (B+) OCP (AC relay OFF)	2 times	2:0 or 2:1	- H-out (Q505 or Q506) shorted - IC1751 is shorted (CV brd)
I-PROT (AC relay OFF)	4 times	4:0 or 4:1	- +13V missing on IC545 - IC545 defective - No HD to FBT (open circuit)
IK (AKB) N/A in IC001, version 1.	5 times	5:0 or 5:1	- IC545 defective - IC001 defective - G2 is improperly adjusted

NOTE: if a B+ over current condition is detected, the vertical deflection output stops simultaneously. The symptom that is diagnosed first by System Control is displayed on the history screen.

The unit must be disconnected from AC power to stop Standby/Timer LED flashing and reset unit.

Failure History Display

Reading Results

The History display can be accessed by quickly pressing the following buttons on the remote control sequentially while the unit is in the Standby Mode:

[Display]———>channel **[5]———>**sound volume **[-]———>[Power ON]**

Display will look like the following:

Self-Diagnostic

2: 000

3: N/A

4: 000

5: 001

101: N/A

The number on the left of the display (e.g. 2:) indicates the Standby/Timer LED flash sequence.

The number on the right of the display (e.g. 000) indicates the number of times the failure occurred.

The display can register up 99 failures.

All failure information is stored in EEPROM IC002 on the A board.

Clearing Display

The failure display should be reset after repair. If the display is not reset, subsequent failure will not be registered. To clear the results display to zero, press the following buttons on the remote control sequentially when the diagnostic screen is displayed:

Channel **[8]———>[ENTER]**

Quitting the Self-Diagnostic Screen

To quit the entire self-diagnostic screen, turn off the power switch either on the remote control or on the main unit.

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CTV300402

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